# Arizona Medicine

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ARIZONA MEDICINE

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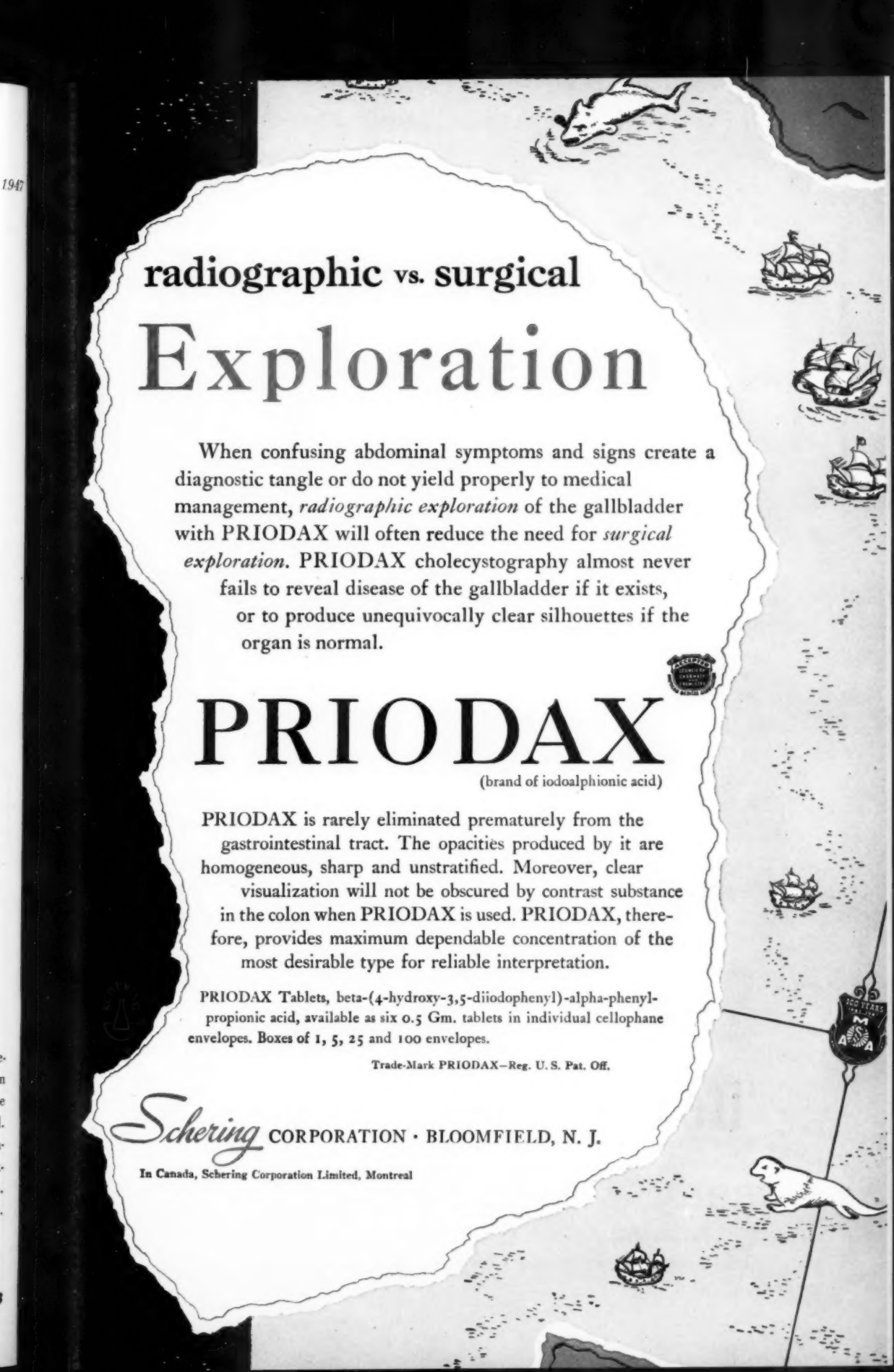
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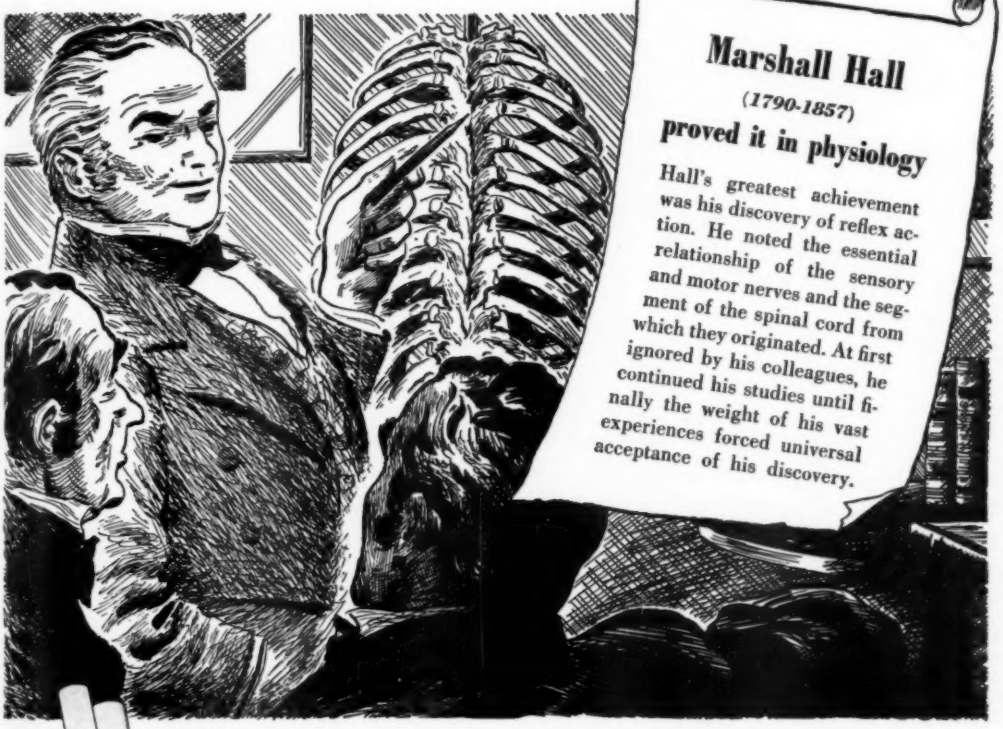

**Marshall Hall**

*(1790-1857)*

**proved it in physiology**

Hall's greatest achievement was his discovery of reflex action. He noted the essential relationship of the sensory and motor nerves and the segment of the spinal cord from which they originated. At first ignored by his colleagues, he continued his studies until finally the weight of his vast experiences forced universal acceptance of his discovery.

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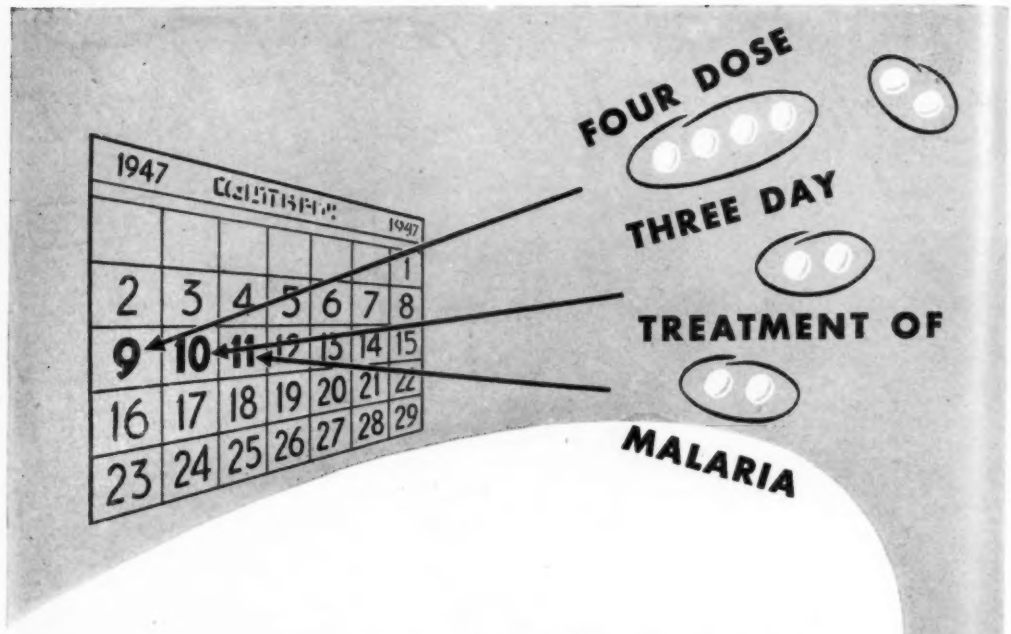


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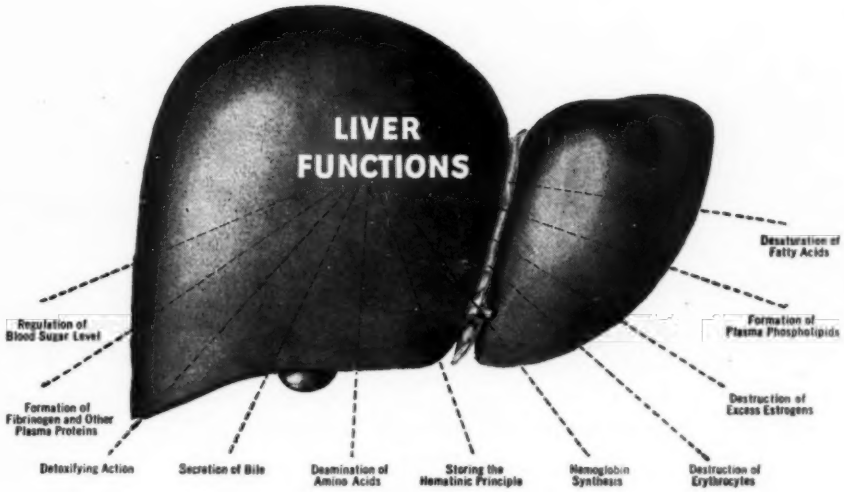


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**The complex nature of the manifold functions of the liver is reflected in the diagram shown above. To maintain its functions in an efficient manner, the liver must be adequately protected against toxic influences. Parenchymatous damage with ensuing decreased functional capacity can lead to severe metabolic derangements.**

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**for use in control of overweight—**

**Benzedrine Sulfate has been accepted by the Council on Pharmacy and Chemistry of the American Medical Association**

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The use of Benzedrine Sulfate alone ordinarily should achieve the desired appetite reduction. Combinations of amphetamine and thyroid serve no useful purpose and may even be dangerous. In this connection, a recent report of the Council (*Drugs for Obesity*, J. A. M. A., June 7, 1947) says: "The fallacy and dangers of overstimulating the body with thyroid and of using laxatives to aid in reduction are well known to the medical profession."

**benzedrine sulfate**

***Smith, Kline & French Laboratories, Philadelphia***

***(racemic amphetamine sulfate, S.K.F.)***

**One of the fundamental drugs in medicine**

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* *Laryngoscope, Feb. 1935, Vol. XLV, No. 2, 149-154*
*Laryngoscope, Jan. 1937, Vol. XLVII, No. 1, 58-60*

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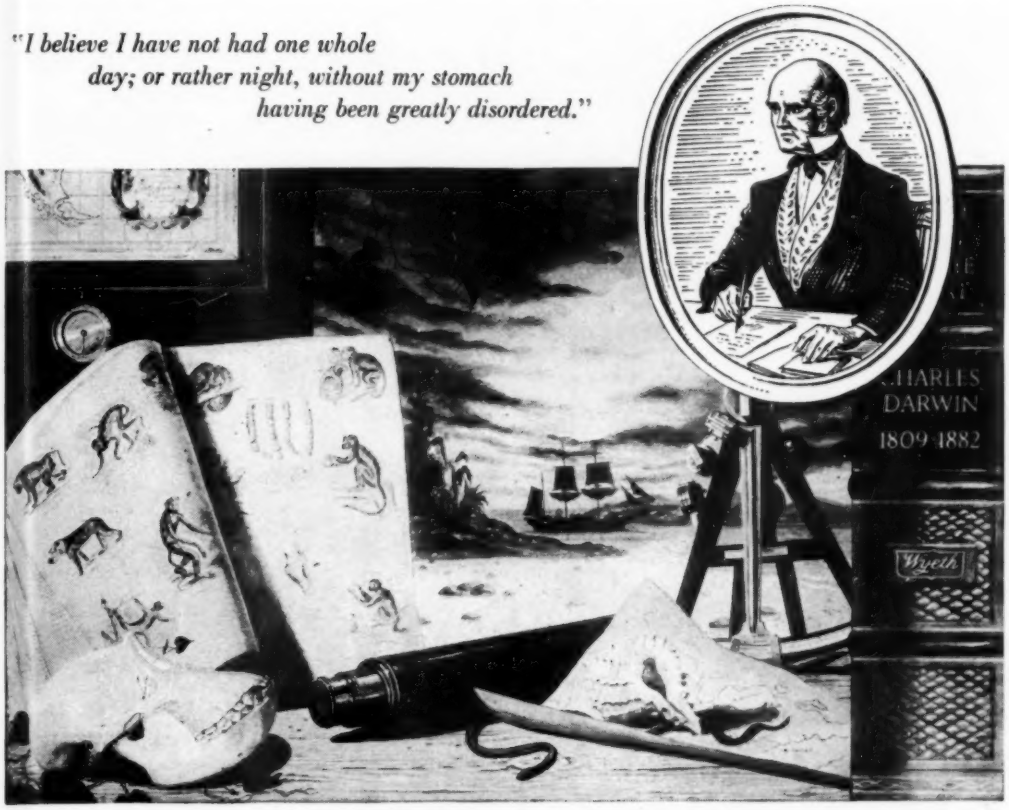
LOS ANGELES, CALIFORNIA
PHARMACEUTICAL CHEMISTS FOR MORE THAN 44 YEARS

*"I believe I have not had one whole day; or rather night, without my stomach having been greatly disordered."*




During the most productive years of his life, Charles Darwin was a victim of peptic ulcer.[1] His might be called the *average* case of peptic ulcer. Had modern medical understanding of ulcer treatment been available to him, his life could have been far more comfortable—and even more productive!

Proper use of an alumina gel antacid and an occasional sedative would doubtless have carried him through his most active years without suffering.

[1]Rehfuss, M. E., *The Ulcer Life*, Clinics 3:480-493 (Oct.) 1944

**PHOSPHALJEL,** Aluminum Phosphate Gel, Wyeth, is unexcelled in the treatment of "average" ulcer cases as well as in stubborn or complicated ones. It provides quick relief from pain . . . lays a protective coating over the inflamed mucosa . . . *safely* buffers gastric acidity with no danger of alkalosis or "acid rebound." Phosphaljel permits a liberal bland diet—patients are more contented during treatment, gain strength and weight more quickly.

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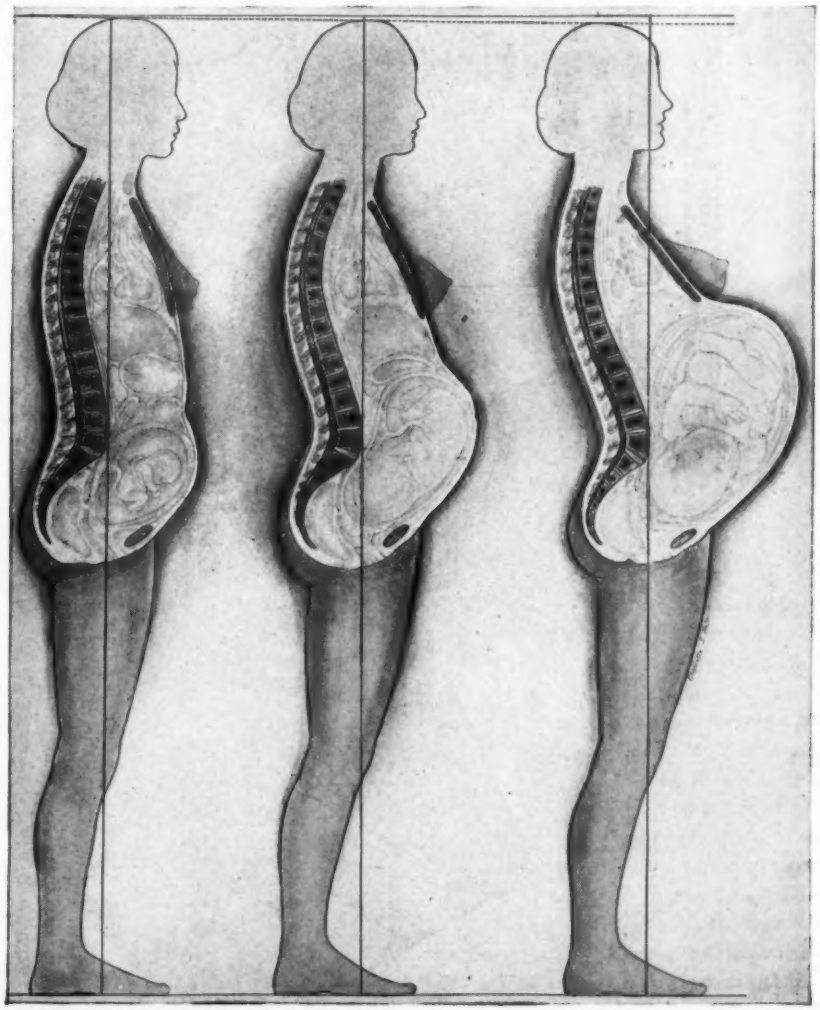
# BODY MECHANICS OF PREGNANCY

• STUDIES FROM LIFE MODELS DURING PREGNANCY • Illustration by Charlotte S. Holt



4 LUNAR MONTHS 7 LUNAR MONTHS 10 LUNAR MONTHS

The postural changes during pregnancy are due to the compensatory backward shift of the center of gravity caused by forward pull of the load of the pregnant uterus.

Note the retracted shoulders, carriage of head (pride of pregnancy), and the accentuation of the natural lumbar lordosis which relieves abnormal tension on back and leg muscles.

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• When children (infants and adults, too) are unable to tolerate the animal proteins in cow's milk, MULL-SOY—the emulsified soy concentrate—is the replacement of choice. It is highly palatable, and easily digestible, without the offending proteins of animal origin.

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# mull-soy

MULL-SOY is a liquid hypoallergenic food prepared from water, soy flour, soy oil, dextrose, sucrose, calcium phosphate, calcium carbonate, salt and soy lecithin; homogenized and sterilized. Available in 15½ fl. oz. cans at drug stores everywhere.

**when milk becomes "forbidden food"**

"by the tenth or twelfth day of life..."

"... vitamin D in a concentrated form ... should be started."[1]

White's Cod Liver Oil Concentrate *Liquid* provides the wholly *natural* vitamins A and D derived exclusively from time-proved cod liver oil itself—the standard by which all antirachitic agents are measured. In liquid form for drop dosage to infants—convenient, palatable, economical.

1. Anderson, N. A.: Penn. Med. J., *48*:566-8 (Mar.) 1945

White Laboratories, Inc., Newark 7, N. J.

# the boy with the "hollow legs"

Periods of rapid growth and heightened metabolism call for *intensified* antirachitic therapy. White's Cod Liver Oil Concentrate *Tablets* provide the wholly *natural* vitamins A and D—in so pleasant tasting a form that even finicky young patients gladly cooperate.

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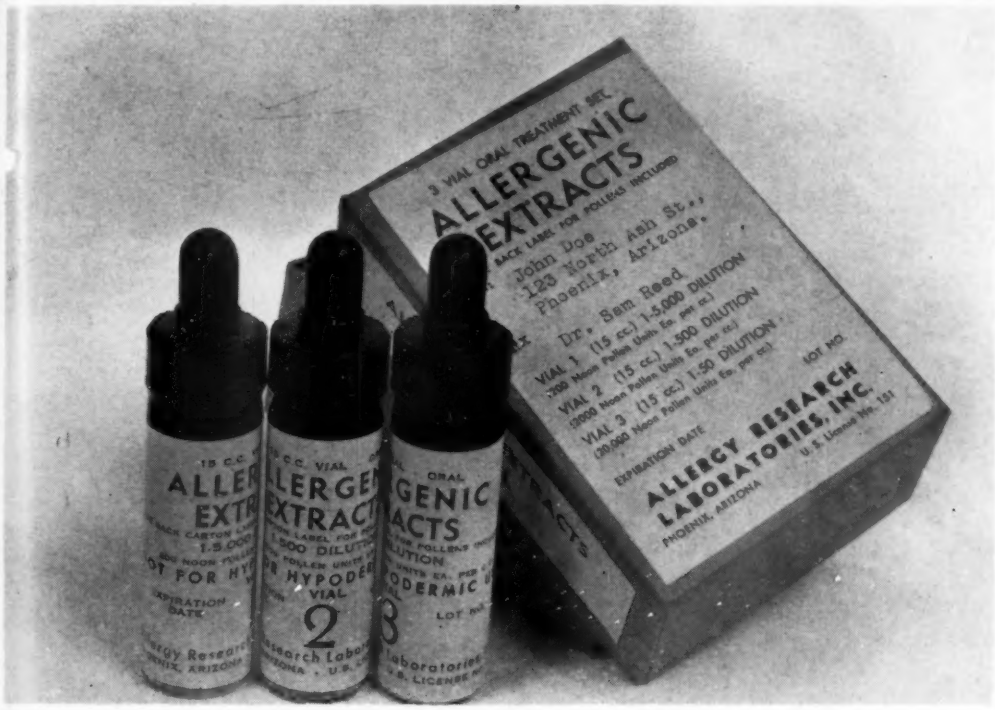


# HAY FEVER

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The oral treatment may be selected for children, highly sensitive patients, individuals who have difficulty in visiting the doctor regularly, and those with an abnormal fear of the needle.

**3-vial, three dilution Oral Treatment Set, individualized to your patients' sensitivities - - - - $10.00**

*An allergy service based on close acquaintance and experience with the botany of the area of your practice.*

**Allergy Research Laboratories, Inc.**

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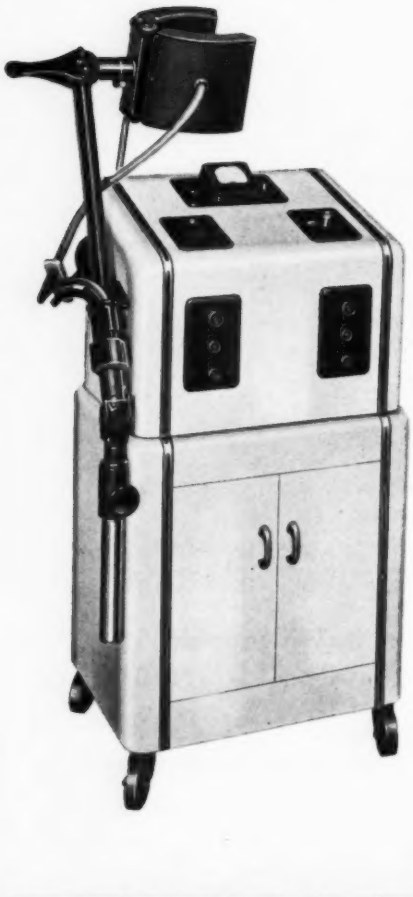
## Only the L-F SW-227 Gives You Both

1. *Every Short Wave Application*
2. *Absolute Frequency Stability*



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## CAREFULLY STANDARDIZED

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ELI LILLY AND COMPANY

INDIANAPOLIS 6, INDIANA, U. S. A.

*A 12x15 reproduction of this Arthur Sarnoff color illustration, suitable for framing, is available upon request.*

# Doctors and Detectives

THE PHYSICIAN is usually among the first to visit the scene of a tragedy. In solving crime, the type and location of wounds, abrasions, or bruises may have distinct significance. Bloodstains, scientifically examined, may provide the convicting evidence. Skeletal remains often reveal important facts concerning sex and age. Police records emphasize the importance of medical aid in the solution of crime.

Broad knowledge, keen observation, and the ability to piece facts together into a coherent whole are characteristic attributes of the physician. These same accomplishments are equally important in the field of medical research. In the Lilly Research Laboratories, physicians team with specialists in many related fields of science to attack problems which confront the clinician.

ARIZONA MEDICINE
*Journal of*
ARIZONA STATE MEDICAL ASSOCIATION

VOL. 4, NO. 5 SEPTEMBER, 1947

# BERYLLIUM GRANULOMATOSIS,

## Alias Miliary Sarcoid, Salem Sarcoid, Miliary Sarcoidosis, Chronic Beryllium Poisoning, or Delayed Chemical Pneumonitis

A Description and Report

by JACKMAN PYRE and
W. H. OATWAY, JR.
*Tucson, Arizona*

### INTRODUCTION

THE first major reports of industrial hazards and diseases were made about forty years ago. It was soon realized that the field would become a large one, and that unusual causes and lesions would be discovered. Some would be the result of a better knowledge of conditions already existing, but others would be due to new materials and processes.

*Beryllium* is one of the metals which has come into an amazingly frequent use. Dozens of processes and alloys require it. It must be handled by workmen. It is apparently capable of producing, in some people, a granulomatous sarcoid disease, chiefly of the lungs, and perhaps in association with a bacterium.

The pathogenesis of the disease is uncertain, and it has not yet been possible to reproduce the syndrome of experimental means. The agent is apparently able to produce a reversible acute chemical pneumonitis if the exposure is massive, or a new, distinct, more common, chronic granulomatosis if the exposure is less.

The first cases of this sarcoid occurred and were recognized as recently as 1943. Most of them were from a single industry in Massachusetts. Other cases in other industries have been found since then. The first report of the condition appeared in an industrial journal in September, 1946. Investigative work has been under way for the past year and a half.

An immediate description of the condition for "Arizona Medicine" seems worthwhile, since known cases move about, unrecognized cases may appear anywhere, the use of beryllium has continued to increase, and information on the subject is not readily available.

A case with characteristic history and findings is reported herewith. It includes a vascular involvement which may be new. The completeness of the report and of the data on the disease is due to the perfect cooperation of several Massachusetts industrial physicians, and of those doing the experimental work at Saranac Lake. They must be commended for their alertness in the almost immediate recognition and analysis of a new hazard and syndrome. The attitude of the involved industries and the insurance companies has also been of the highest order.

### REPORT OF A CASE

The patient, a white male, aged 34 years, presented himself for treatment shortly after his arrival in Tucson in August, 1946. A coincidental request for supervision of his care was received a few days later from his former physician in Saranac Lake, N. Y. His chief complaints were cough, headache, loss of weight, and shortness of breath.

His illness began in the fall of 1945 with recurrent severe headaches, soon followed by other symptoms. He consulted several physicians in Massachusetts and eventually the presence of "a rare condition about which little was known" was suspected. The patient was sent to see the late Dr. Leroy Gardner of the Saranac Laboratory, and was hospitalized at Trudeau Sanatorium for a month in May, 1946 for a detailed examination. (Since then a small unit has been set up at Trudeau by grants from the U. S. Navy, U. S. Public Health Service and several industrial groups for the housing and study of other such cases. Dr. Klemperer of Harvard is in charge of biological research and Dr. George Wright of the physiological investigation.)

He then came to Arizona, in spite of objections that his condition might not be understood and

that it was still "not stabilized." We were able to immediately obtain information on his case and its origin through the cooperation of all physicians previously concerned, as well as considerable latitude on expenses from the insurance company.

The details of his history and progress are interesting and characteristic:

1. **Family History** — The patient was born April 11, 1913. His parents, three brothers, and a sister are all living and well. There is no family history of tuberculosis or diabetes.

2. **Past Medical History**—His tonsils and adenoids were removed when he was three (3) years of age. He had measles, whooping cough, diphtheria, influenza and pneumonia before the age of six (6) years. At the age of 14 years he had an attack of "intestinal jaundice;" at the age of 19 years he sustained a gun-shot wound in the left shoulder. He was otherwise well until January 1941 when he had a "flare-up of high blood pressure." He weighed 185-200 lbs. from 1935-1945.

X-ray films of the chest were taken in 1941 and 1944 by the company for which he worked, and reported to be "perfect." (This is confirmed by the company physician.)

3. **Social History.**—He was an athlete in high school. He was married in 1933 and the wife and one child are normal and well. Their lungs have been normal by x-ray films and recent fluoroscopy. His habits have been regular, alcoholic intake slight, and he has smoked 15 cigarettes per day. There is no history of venereal disease.

4. **Occupational History**—The patient worked as a waiter, usher, taxi-cab driver, bakery salesman, theater manager, and instructor in a driving-school between 1929 and 1940. He never had worked in a "dusty" occupation, nor in one using silica.

In September 1940 he began work for a company which manufactured electrical equipment. For several months his job was the coating of fluorescent tubes, using a liquid containing a powder which he says was composed of "beryllium oxide and zinc oxide." After the solution had dried on the tubes, there was always a residue on his hands and clothes from spillage. In March, 1941 he spent six weeks in the "solution room" mixing liquids and powder into the solution which he had used in the "coating-room." This was also a "sloppy job" with spillage on the clothes and body.

In April, 1941 he took a position with another electric company where he assembled motors. In February, 1944 he went to the company apprentice school, taking a "machine course," for nine months. When the course was completed he began work for the company as a tool-and-method planner in the Wage Rate and Planning Department. He continued there until his illness began in the fall of 1945.

5. **History of Present Illness**—The first symptom was headache. It was severe, mostly occipital, and recurrent. It began in August, 1945. Examination of his eyes and a prescription for glasses was of no help.

He then noted loss of weight and appetite, shortness of breath, cough, nervousness and insomnia. He went to a doctor who took a brief history, did no examination, said that the condition would straighten itself out, and gave him some pills. The pills were of no help.

The headache became more severe, so he went to another physician in a nearby town, with the same results—"no examination, more pills, another visit, more pills, no results."

In April, 1946 another doctor took x-ray films of his head. "Calcium deposits" were seen and said not to be unusual, but the doctor suggested a complete examination by a general practitioner. By then his symptoms included fatigue, attacks of palpitation of the heart, slight expectoration, development of papules on the dorsum of the hands, and a further weight loss to a total of 30 pounds. The office examination did not satisfy the physician, who sent him to the hospital for a more complete study.

He entered the hospital on April 11, 1946 for routine laboratory tests, a tuberculin skin-test, a spinal puncture, neurological consultation, and a chest x-ray. On seeing the film the physician immediately recognized the possible presence of a "chemical pneumonitis," with the presumptive diagnosis of "beryllium poisoning," following "exposure to fluorescent powder." The patient was told of his condition, and that there was only one person who had much knowledge of the rare disease—a Dr. Gardner.

On May 3, 1946 he was admitted to Trudéau Sanatorium, where special studies were made under the direction of Dr. Leroy Gardner, Director of the Saranac Laboratory of the Trudeau Foundation. Examination there included most of the history as given, and other details which they have supplied from their records—

"On physical examination he showed evidence of weight loss. There was a slight cyanosis of the lips, fingers, and hands. The heart was normal except for widening of dullness at the apex. The inguinal nodes were palpable. There were superficial varicosities of the legs. Dusky purplish papules, 1 to 3 mm. in size, were present on the dorsum of the hands and fingers. Fine rales were heard at both apices.

X-ray films of the chest showed a bilateral, fibrotic, nodular infiltration, diffuse but more marked in the upper two thirds, and with a slight bilateral hilar accentuation. Lateral films added no information. Comparison with films taken in April, and of the admission and discharge films, showed no change. Planigrams indicated an enlargement of the hilar nodes. X-ray examination of the bones of the hands, feet, skull, and intestinal tract showed no evidence of pathology.

The white blood count and sedimentation rate were normal but the RBC was 7,420,000, the Hb. was 138% (20.01 gms), the color index 0.93, volume index 0.94, saturation index 0.93, and the hematocrit 66.5%. The blood serum proteins were normal with an A/G ratio of 1.9; NPN, calcium, and phosphorus were normal; but the serum alkaline phosphate was 22.38 and 21.8 King-Armstrong units (compared with a normal range 4-12). The urine was normal, as was an electrocardiogram.

The patient failed to react to 10 mgs. of Old Tuberculin by intracutaneous test. Sputum concentrates were negative by smear and culture for tubercle bacilli.

A biopsy of one of the papular lesions on the hand showed typical granulomata, and was considered diagnostic.

The respiratory physiology was studied by Dr. George Wright but it is not of value for this report."

During the month at Trudeau Sanatorium he had six severe headaches, and an attack of palpitation lasting half an hour. He was discharged with a slightly improved weight (157 lbs.). The impression, without considering his industrial history, was "probable Boeck's Sarcoid."

**Progress**—The patient went home, continued to rest, and then made plans to go to Arizona, since he had been warned of the hazard from respiratory infections. He was seen shortly after

his arrival in Tucson on July 26, 1946, about a year after his first symptoms and three months after the discovery of his lung lesions.

His general condition was perhaps slightly worse than at the time of his Trudeau examination. He had lost another 25 pounds, and his headaches often lasted 10 to 14 hours. Dyspnea was severe after any exertion. Periods of palpitation occurred during which the pulse abruptly doubled, and which lasted 2 to 20 minutes.

The only new signs on examination were a post-nasal discharge; slight enlargement of the cervical and axillary nodes; a BP of 130/80; mild tenderness in the liver area; and more rales at the R. apex. The RBC and Hb were slightly above normal; the total WBC slightly below normal. An x-ray film of the lungs showed no change when compared with previous films.

He was advised to rest, and a series of trials were begun to find a suitable sedative for his cough and an analgesic for his headaches. The cough has increased and subsided for no apparent reason, and no therapy has been regularly effective, including the use of codeine, terpin hydrate, steam, oxygen, penicillin aerosol, aminophylin, and ephedrine-phenobarbital combinations. The headache can be relieved by demerol, but this has recurrently produced a borderline addiction.

During the past ten months in Tucson the patient has been hospitalized six times for a total of 42 days. Only the outstanding features will be mentioned:

August 9. A rapid irregular heart beat was diagnosed as auricular fibrillation. There were crackling rales in both lung fields, the liver was enlarged to 2 cm. below the R. costal margin, and the patient was severely dyspneic and nauseated. At about the time of arrival at the hospital the attack ceased and an EGG showed only a sinus tachycardia and a left ventricular preponderance. As observed in the next few days, the temperature was normal, the pulse averaged 100/40 minute, and the respirations 30-40 minute; BP —130/90; blood serology and culture were negative; and there was only a mild polycythemia. He was discharged as improved in five days.

September 6—After a trip to town he developed pain in the precordial area and an increased cough. On examination there were coarse rales in the left chest and a friction rub anteriorly. He had some pruritic urticarial welts on the hands and feet. Fluoroscopy and, later, an x-ray film showed a 4 cm. area of opacity in the middle third of the left lung. The fever was 101 degrees and he was hospitalized for administration of penicillin (40,000 units every three (3) hours). The temperature became normal in 24 hours and remained so. The BP was 145/110 and the urine showed a faint trace of albumin and a few casts. The RBC, WBC, general adenopathy, etc., were as usual. The pneumonia cleared rapidly by x-ray film.

October 31. The patient was hospitalized because of the severity of headaches, emeses, a sharp rise of BP to 180/120, and the need for a spinal tap. The temperature was normal; fundi showed dilated veins and there were rales at both lung bases. The RBC and WBC were normal but the urine contained 6-10 RBC/HPF. The blood NPN was 44.5 mgm. and 41.5 mgm. (N. 25-35). The spinal fluid pressure was 250 mm. of water; protein and chlorides, normal; glucose 80 mgm.; and the colloidal gold and culture were negative. The headache was relieved. A second urine obtained before discharge was normal, and the BP had dropped to 140/100. The episode seemed to be a vascular spasm, with associated increase of intra-cranial pressure and a renal dysfunction.

December 23. He was hospitalized because of pain in the right chest and an increased cough. (He had had a total of three episodes of acute pneumonitis during the fall.) An x-ray film showed no change. The TPR, physical signs, RBC, WBC and EKG showed no change from the previous abnormalities. The NPN was 35 mgm., the urine showed a few RBC and a trace of albumin. The sputum showed no acid-fast bacilli or diphtheroids, but contained gram positive bacilli and diplococci. He was given penicillin, improved, and was discharged in 17 days.

February 11. He was sent to the hospital for a cough which was severe enough to resist narcotics. He had had occasional headaches, sometimes with hypertension. Physical and laboratory examinations were as usual, except for 15-20 WBC/LPF in a urine specimen. The pyuria cleared after intravenous glucose; his cough decreased, and he was released.

April 5. Hospitalized for nursing care because of an abscess in the left buttock—the result of injections of penicillin given at home. There was no fever or leucocytosis after the abscess was incised, and the other laboratory studies were as usual. There were crepitant rales throughout both lung fields and the x-ray film showed a suggestion of "increased congestion" in the upper right lung. He was discharged with a healed abscess and decreased cough.

April 21. The patient was hospitalized because use of demerol as cough control had gotten out of hand. He was discharged cured of the habit on May 16, 1947 but shortly thereafter secured 24 grains of codeine which he took over a 24 hour period. He was admitted semi-comatose on May 21 and rapidly recovered from effects of this narcotic. At this time routine laboratory studies were done. The results were: x-ray chest, no change; NPN 42.3; Protein 6.7 with 3.8 albumin and 2.9 globulin; urine, a few granulated casts; EKG in normal limits. A concentrated morning urine was sent to the laboratory for quantitative study for beryllium by polarographic and quantitative chemical studies using quinalezerine, cucurmine and uranium acetate techniques. None of these tests indicated a demonstrable quantity of beryllium. On May 26 he was given a 10 day course of injections of 10% BAL in peanut oil to a total of 45 c.c. on a schedule recommended "for serious toxic reactions resulting from arsenotherapy" by Doctor Harry Eagle. Urine was analized for beryllium one week after beginning treatment and two weeks after. He had the usual toxic manifestations from BAL—nausea, pruritis inside the mouth and slight dizziness. No improvement was noticed in his general condition. His dyspnea and cough were if anything, more pronounced after treatment. This was attributed by him to the extreme Arizona heat and on July 7, 1947 he returned to the East with the intention of placing himself back under the care of those working on beryllium poisoning in that locality.

## COMMENT

During the past ten months the patient has changed only slightly. The x-ray findings are similar to those of a year ago. The rales are now heard more extensively. The skin papules have shown transient slight remissions and recurrences, but are about the same as when first seen. They are pinkish tan papules, chiefly on

the sides and extensor surfaces of the fingers and elbows. He has developed an intermittent hypertension which at times has been associated with headaches, the finding of blood and urine changes of renal dysfunction, and an elevated spinal fluid pressure. The slight general hypertrophy of lymph nodes persists. The paroxysmal cardiac irregularity (type not proved) has accentuated a passive congestion of the liver. The evidences of emphysema and hypoxemia are the same, with heart strain beginning to show. A pitting edema of the ankles has occurred in late May, 1947. There has been no evidence of an infectiousness. He has become more irritable, emotional and despondent. A most recent symptom has been a single hematemesis of about a pint, occurring after the intake of several drinks of whiskey.

An analysis of the signs and symptoms of this patient indicates that the following organs and tissues are known to be involved:

(1) The lungs—by a generalized, nodular, fibrous, truncal infiltration; a secondary emphysema.

(2) The lymph nodes—by a hilar, axillary, cervical and slight general enlargement.

(3) The skin—by granulomata (proved by biopsy).

(4) The cardio-vascular system—it is not certain whether the involvement is due to beryllium, to a coincidental vascular spasm, to infiltration, or to a combination of causes. The hypertension began during his exposure to the chemicals and the headaches and cardiac irregularities began with the onset of the sarcoidosis. Renal signs and evidence of mild cardiac insufficiency have developed in the past year. The presence of compensatory emphysema is a complicating and additive factor.

The hematemesis could be due to the hypertension, back pressure from the right side of the heart, local gastric changes, or venous engorgement from hepatic lesions.

One can say that the condition is typical of the disease as it has been described. The x-ray findings are typical; the nodal and skin changes are typical and diagnostic; and the progress has been typical,—an adequate exposure, a late onset, unchanging lesions in the films, a tendency to secondary respiratory infections, heart strain, etc. The normal x-ray films in 1944, the negative tuberculin tests, and the negative bacteriological findings also conform to the pattern.

It must be said that without an occupational history the picture could be that of Boeck's sarcoid and its various synonyms, even to the lack of a tuberculin reaction, though the cardio-vascular elements are unusual.

## DISCUSSION OF BERYLLIUM GRANULOMATOSIS

It has been possible to obtain a satisfactory outline of the chronic "beryllium" effect, although this information did not become available until the fall of 1946. The sources consist of the two reports which are now available and the communications from the three physicians who have seen a majority of the cases. Much of the information is definite and regular but caution and skepticism have been stressed where they seem indicated.

Beryllium was first mentioned as a possible hazard in several European reports (Weber, 1933, Germany; Fabroni, 1935, Italy, who used the term "berylliosis"; Gelman, 1936, Russia; Berkovits and Izrael, 1940, Germany; Meyer, 1942, Germany). The metal was used very little in the United States until the war years. In 1943 Van Ordstrand, et al., in Ohio, noted that it could produce an *acute* chemical pneumonitis. The condition resulted from an overwhelming exposure to beryllium dust or fumes and occurred in two metallurgical plants which made beryllium oxide and other beryllium compounds. The pneumonitis was occasionally quickly fatal but usually cleared completely in a few days or weeks. During the following year, several reports were published on acute conditions resulting from contact with beryllium. In 1945 Van Ordstrand and co-workers summarized the acute illnesses (skin, eyes, nose, throat, and lungs) due to "beryllium poisoning" from the metal and several of its compounds. About one hundred and fifty cases of the acute lesions with pulmonary edema and reversability have been reported in various industries.

The *chronic* effect, with which we are concerned, is "beryllium granulomatosis" or "sarcoid." It is a new industrial disease and it appears to be "peculiar to industries utilizing ber-

yllium." Various names have been applied to the disease. Its similarity to a sarcoid led to the use of that term; its characteristic miliary-type of lesion allowed that word to be used; its contrast with the acute chemical pneumonitis suggested the use of "delayed" to Hardy et al.; the need for a distinct, descriptive name caused Gardner to combine the etiology and pathology into "beryllium granulomatosis," which may be the best name.

*Beryllium*—The industries which use some form of beryllium are surprisngly numerous and variegated. They include those which make certain alloys of copper, aluminum, magnesium, nickel, iron, and silver; fluorescent lamps, in which beryllium is a phosphor; radio tubes; electronic tubes; incandescent lamps; neon-sign tubing; x-ray-tube windows; electric heating elements; phosphorescent luminous indicators; refractories (crucibles); vitreous enamels; gas mantles; textile fibres; and, by inference, atomic energy. The only type of brass-casting which is hazardous is that in which beryllium is used.

Though beryllium has been incriminated in all cases of the disease, its most dangerous form has not been identified. Beryllium silicate has been suspected as the causative agent, but zinc beryllium silicate and beryllium oxide compounds have been the ones used in some hazardous processes. Fumes, powders and liquid solutions have all been the medium of contact in different industries, but a dusty environment (atmospheric contamination) is not correlated with susceptibility to the chronic disease.

*Industrial History*—The first knowledge that an industrial hazard could produce sarcoid came from cases among the employees of a company which makes fluorescent lamps. The first case was that of a woman who became ill in December, 1942. Her symptoms were loss of weight and dyspnea. An x-ray of the lungs showed a diffuse nodular lesion, unlike tuberculosis. She had no fever and there were no tubercle bacilli in the sputum. She died of what was called "edema of the larynx." An autopsy showed a "miliary sarcoidosis" of the lungs, with microscopic foci in the liver, spleen, and lymph nodes. It was similar to the sarcoid of Boeck, and no special significance was attached to the case.

In the recent twelve months, however, ten more employees of the same plant became ill with the same symptoms and x-ray findings. Eventually, a total of thirty-one cases were found among the six hundred employees. All had the same pattern of disease; all had worked on various floors of the same building; all had a single common factor in their work—an exposure to fluorescent powder during a period of a few months in 1940-41. Those developing the disease were not necessarily subject to the greatest exposure; some handled the powder and some did not. No reason has been found for the selective occurrence in thirty-one out of six hundred employees. The plant was considered "clean."

The fluorescent powder was composed of zinc beryllium silicate, magnesium tungstate, and zinc silicate. Contact could have been with the powder, or a solution of the powder.

Four cases of an acute chemical pneumonitis (similar to the cases which Van Ordstrand and Hughes described as due to beryllium oxide) were found in the plant which manufactured the fluorescent powder. There was obvious exposure to dusts in this plant.

Evidence of the occurrence of the chronic granulomatous clinical picture in employees of other plants and industries has been accumulating. Two cases occurred in another fluorescent lamp factory; several occurred in metallurgical plants; a few in beryllium casting shops; some in the radio-tube industry; and several among neon-sign tube benders. Four deaths resulted from a similar chronic disease of workers in a brass-casting shop where alloys of beryllium copper were made. The true incidence and distribution of cases in industry is still unknown, since a case-finding search is not yet general. The Saranac Laboratory has a record of one hundred cases of sarcoid and possible sarcoid, from industries with a potential beryllium hazard; sixty are considered to be genuine examples. They have personally examined thirty-three of the chronic cases, and have examined material from twelve autopsies.

*Pathology*—In general, there are two different pulmonary reactions to beryllium:

1. An *acute* pulmonary reaction, following massive exposure to dust or fumes of beryllium processing. The outcome is sometimes fatal in a few days, but usually clears in a few days or weeks. It is like a pneumonia without infection.

2. A chronic reaction, beginning three or four years after exposure, producing a granulomatosis and having a high mortality. The duration is from six months to four years and the prog-

ress is marked by cachexia, limited lung function, and heart failure.

Although the period of study and the number of reports have been limited, it is believed that the results of beryllium exposure differ slightly in pathology—

1. from the same exposure,
2. in various industries,
3. from other pneumoconioses,
4. from Boeck's sarcoid.

The data on *pathology* have been obtained, chiefly by Dr. Gardner, from sixteen fatal cases. Four were acute, but twelve were of the chronic variety (six from the fluorescent-lamp plants, five from beryllium copper manufacture, and one from the radio-tube processing).

The gross lung lesion in the *chronic* disease is usually a tiny "granuloma." Microscopically it consists of a granulomatous reaction in the alveolar walls, producing a compact proliferation of cells. A central degeneration is often present. It is the same general type of lesion as a tubercle. It is surrounded by some degree of emphysema.

The hilar lymph nodes, other lymph nodes, liver, and spleen often contain microscopic lesions of the same type. The skin lesions are shotty papules composed of granulomatous tissue.

*Chemical analysis* of lung tissues has shown—

1. low ash values—1 to 3% (the pneumoconioses 3 to 34%).
2. low silica content—a maximum of 4.36% (normal silica content—7.29%).
3. no abnormal amounts of other metals.
4. *too little beryllium* to be detected by chemical methods, although one case showed 0.54%. Spectroscopic analysis shows 0.1 to 5.0 micrograms per 6 to 7 gms. of dried lung.

*Bacteriology* — Bacterial studies have shown the occasional presence of only one type of organism. All examinations for cocci, other bacilli, fungi, and tubercle bacilli have been negative both in vivo and at post mortem.

The occasional organism is a partially acid-fact diphtheroid bacillus which has been found in the sputum of a number of cases, and recovered in small numbers from the lesions of several cases at post mortem. The bacillus is quite small, varies in morphology, and varies markedly in staining characteristics,—it is sometimes resistant to decolorization by acid and alcohol; it sometimes contains only acid-fast granules; and it sometimes is completely decolorized. It requires about two weeks to develope in culture, and grows best on glucose blood broth and glucose blood agar.

The organism is characteristic of these cases, and has not been found in control material. (It is remembered that small numbers of acid-fast bacilli have been found in the lesions of Boeck's sarcoid, and that such lesions rarely caseate.)

*Experimental*—The organism has not been found to be pathogenic for animals. It has not been possible to produce the disease in dogs, rabbits, guinea-pigs, white rats, or white mice by the inhalation or injection of zinc beryllium silicate, beryllium oxide, or mixed phosphors obtained from fluorescent lamps. (This is a notable difference from silicosis, which is quite easy to produce experimentally.) The suspected compounds have also been ineffective in combination with the acid-fast diphtheroid and with tubercle bacilli.

Animal species vary in susceptibility to the toxic effects of beryllium compounds.

The only chronic lesion which can be produced by beryllium compounds is a highly malignant bone sarcoma which often follows the intravenous injection into rabbits of the relatively insoluble beryllium oxide and zinc beryllium silicate, after a significant period of five to seven months latency. The sarcomas are like those seen in radium dial painters, but neither the tumors nor beryllium are radioactive. None of eighty other minerals or compounds has produced this result in animals, and there is no counterpart in the bones of the human sarcoid cases.

It must be concluded that, though the diphtheroid has been recovered from human cases, it has not been shown to be a causative agent, is not pathogenic for animals by the methods used so far, and must be considered with caution in any hypothesis. As Dr. Gardner remarked, "Nobody loves a diphtheroid."

*Clinical Findings*—The first formal report of clinical data was published in September, 1946 by Hardy and Fabershaw. They described seventeen cases of what they called "delayed chemical pneumonitis." Their report was supplemented by the data and review of Gardner in November.

The *symptoms* may begin any time up to five years after exposure and are usually insidious in onset. They consist of anorexia, loss of weight,

dyspnea, and a cough—worse in the morning, and sometimes non-productive. There is a varying individual nervous reaction, dependent on the personality, anxiety, the presence of hypoxemia, and perhaps on the particular industry and chemical.

Other symptoms which occasionally occur are weakness, easy fatigue, sweating, insomnia, nausea, vomiting, diarrhea and chest pain.

The *symptomatic* phases of the disease can be divided into the mild phase of onset; the phase of "activity," which stems from the first phase, lasts for a variable period of months, and should be stabilized for safety; a chronic phase of constant symptoms; and (in some cases) a terminal phase which results from cardio-respiratory insufficiency.

The *physical signs* in the chest depend upon greater transmission of breath sounds and fremitus, a narrowing of the air passages, and some increase in secretions. The increased transmission of sounds is generally masked by a compensatory emphysema, which in turn produces tachypnea, dyspnea, cyanosis and the signs of an emphysematous chest.

Fever is rare in uncomplicated cases. The patient is usually thin, sometimes agitated. The exact distribution of skin lesions can not be deduced from the few cases in which they have occurred, but they have been found on the dorsum of the hands and arms; it is not certain whether they are due to contact. Edema was found in one-third of Hardy's cases, and two cases had clubbing of the digits. Cardiac findings were those of irritability, occasional right ventricular enlargement, and in several cases a *lowering* of the blood pressure.

Changes in the lungs *by x-ray* apparently begin abruptly without any preceding abnormality. A maximum pathological change is reached in about two months, after which there is scanty progress in the lesions. Emphysema can soon be noted between and around the nodules, with a consequent enlargement of lung size, a box-shaped chest, and a flattening of the diaphragm. Hilar lymph-node enlargement may be visible but is not as great as in Boeck's sarcoid.

There are two lesion patterns by x-ray:

1. A fine miliary strippling which obliterates the trunk markings, begins in the mid-lung fields, and later becomes generalized.
2. A larger nodulation (up to 5 mm.), coarser and less discrete, with occasional confluence. This type is similar to nodular silicosis.

Pneumonia is a common complication and may temporarily modify the basic pattern.

There are no abnormalities of the bones by x-ray.

Abnormalities of various *laboratory tests* are rarely due to the disease, but to its secondary effects—the signs of inflammation or tissue destruction are meagre; the signs of abnormal physiology are common.

The white blood count is usually normal. The red blood cells and hemoglobin are often increased to form a secondary polycythemia. The sedimentation rate is normal or only mildly increased. Tests of pulmonary volumina show a decrease in respiratory function. The bacteriology has already been discussed. The blood serology is negative. The tuberculin test is usually negative (four or six cases in the Hardy series). Urinalyses have shown albuminuria and pyuria in about half of the cases, with an occasional case showing microscopic hematuria.

The *clinical progress* of the case follows that of the pathology of the x-ray changes in the lungs. The "stage of activity" includes the development of symptoms and the occurence of skin lesions (which may subside later). Secondary respiratory infections are frequent and present a serious hazard. The general prognosis is said to be that of heart disease and the common cause of death is a right heart failure. The mechanism probably depends upon a limitation of the capillary size and network, the effect of hypoxemia on the heart muscle, plus a conjectural toxic effect of the causative chemical.

The possible mutation of this kind of sarcoid into tuberculosis (reported as a frequent occurrence in cases of Boeck's sarcoid) is speculative. The potential exists, but the duration of "beryllium" sarcoid cases has not been long enough to provide evidence.

*Therapy* has had no effect on the granulomatosis. Neoarsphenamine, the sulfonamides, iodides, penicillin, etc., have been valueless. One case with a fever and bacteremia was given streptomycin intramuscularly by Dr. Gardner—the bacteremia cleared during therapy, but when the meagre supply ran out the culture again became positive; no clinical or x-ray change occurred.

The treatment recommended by the industrial physicians is symptomatic. Rest is advised dur-

ing the "active phase." Excesses and strain of any sort are prohibited and the patient is to be kept comfortable and cheerful. If the condition permits, work is not only possible but advisable, since it occupies time and prevents depression.

It would seem worth while to try streptomycin for longer periods of time, both by injection and inhalation. The occasional presence of acid-fast organisms, the uncertainty about the beryllium etiology, and the gloomy prognosis would make the hazards of the drug unimportant. Therapy would theoretically be most effective before fibrous changes had occurred.

Another method of theoretical value would be the use of BAL, the anti-lewisite compound which has been effective in mobilizing and neutralizing arsenicals, mercury, and gold from the tissue. It is not certainly known that the excessive presence of beryllium is a cause of the disease, nor how the metal combines with the cells. The results in our case have been negative.

## CONCLUSIONS

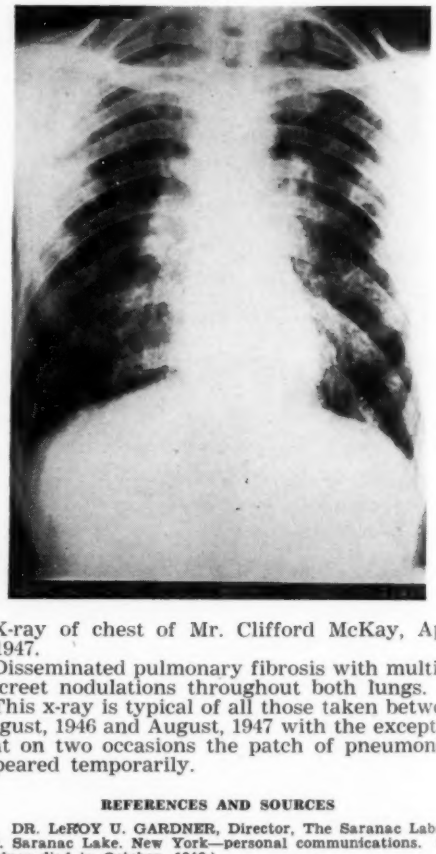
Beryllium granulomatosis is a new industrial disease of great potential importance. The metal is used in a large number of processes and industries throughout the world. Known or unrecognized cases may appear in the offices of Arizona internists and dermatologists at any time.

The causative agent apparently is some compound of beryllium, but its action is not understood, its relationship to a bizarre and sometimes concomitant diphtheroid bacillus is unknown, and animal experiments have been fruitless.

The pathology and clinical picture are quite standardized, and they are quite different from an acute, transient lesion which beryllium can also cause. The x-ray findings are similar to the pneumoconioses, to other sarcoids, and to certain forms of tuberculosis.

A case has been reported which parallels the small number of chronic cases recorded during the past nine months, both in diagnostic feature and progress. The diphtheroids have not been found in the sputum, but a skin-biopsy has been positive. A serious, irritative, cardio-vasculorenal condition with hypertension has been present which, though not previously described, has occurred synchronously with the exposure to beryllium and the development of the granulomatous lesion.

All cases of sarcoidosis should be investigated from the standpoint of occupational history. Certain methods of treatment remain to be given a more adequate trial, but the only reliance at present should be on prevention. Beryllium compounds must be handled as potentially dangerous materials.



X-ray of chest of Mr. Clifford McKay, April 6, 1947.

Disseminated pulmonary fibrosis with multiple discreet nodulations throughout both lungs.

This x-ray is typical of all those taken between August, 1946 and August, 1947 with the exception that on two occasions the patch of pneumonitis appeared temporarily.

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# PHYSICAL EXAMINATION OF THE LUNGS

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VERY few, if any, of the younger physicians are acquainted with the methods and the interpretation of the results of an adequate physical examination of the chest. This is due to the fact that they have not been taught these fundamental principles, because their teachers either did not know them or deemed them unnecessary. The idea has become prevalent that roentgenograms of the chest is the only examination of the lungs that is necessary and that such an examination gives all information which can be obtained. Such an idea is pernicious and false, and is not only increasing the cost of medical care unnecessarily in many instances, but in many other instances causes the patient to receive inferior, inadequate and improper medical care. The advancement of medicine always has been and always will be by the addition of advancements to our known and established knowledge and not by discarding old and time established methods. Such methods will never become antiquated, because they have become thoroughly established by the past Mental Giants of our profession. It is not my intention to belittle the roentgenograms of the chest. We have overemphasized them for many years in order that they should be employed in their proper place. Such an emphasis, however, has caused many physicians to forget, or never have learned, certain fundamentals of the physical examination of the chest. In other words, the pendulum has swung too far.

The outstanding deficit in knowledge appears to be in regards to excursions of the chest and to immediate auscultation and immediate percussion. The mechanism of excursion of the different components of the chest has not been emphasized to most medical students. Very few internes, residents and young physicians are familiar with available methods to ascertain the different excursions of the thorax and they are unable to interpret the observed alterations of excursions in the different abnormalities within the chest. A brief outline of these points will be the subject of this discussion.

The volume of the thoracic cavity is altered by movements of the thoracic cage and diaphragm. The undulatory character of the movement of the second, third, fourth and fifth ribs is the normal mechanism of movement of these ribs and certain diseases of the underlying lung will cause this undulatory character of movement to disappear and be replaced by simul-

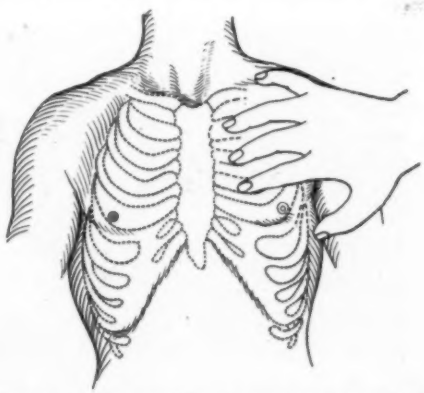

Figure 1. The method of ascertaining the undulatory movement of the ribs is shown diagramatically.

Presented at the Annual Meeting of Arizona State Medical Association, Phoenix, May 3, 1946.

taneous movements of all these ribs. The undulatory movement of these ribs can be ascertained by placing a finger in the intercostal space above each rib and exerting pressure firmly posteriorly and caudally, as shown in figure 1. By this procedure the second rib is felt to move up, followed by the third, then the fourth and then the fifth during inspiration. The reverse order of movement is observed during expiration. Loss of this undulatory movement, as emphasized by Hoover, signifies disease in the underlying lung. It may be the first objective manifestation obtainable in pneumonia and I have observed it as long as 24 to 48 hours before pneumonic consolidation could be ascertained by any other method including the roentgenograms. A patient recently observed illustrates another value of this method of examination. In this case the left thoracic cage was smaller and moved less than the right. The undulatory movement of the ribs was present, however, and its presence signified that the observed abnormalities were not due to disease in the underlying lung but to something within the chest wall. A scoliosis of the spine, which could have easily been overlooked, accounted for the observed abnormality of the thoracic cage.

Study of the excursions of the thorax should include not only the extent, but also the vigor of movement. The excursion of the two sides of the thoracic cage ascertained with the patient in the supine position by a combination of palpation and inspection becomes more valuable and abnormalities can be ascertained earlier if slight, but firm pressure is applied by the palpating hands. By this method the extent and vigor of movement of the two sides can be ascertained during quiet and deep inspiration. In many instances alterations in extent or vigor of excursions will be apparent only during quiet and not forced inspiration. In many others the reverse will be true.

Figure 2. The method for estimating the extent and vigor of movement of the medial costal margins.

Figure 3. The method for estimating the extent and vigor of movement of the lateral costal margins.

The costal margins move outward and upward with vigor during inspiration in the normal individual. This is due to the mechanical advantage of the intercostal muscles over that of the diaphragm during inspiration. Alterations in the extent and vigor of movement of the costal margins, as pointed out by Hoover, reflects alterations in the mechanical relationship between the intercostal muscles and the diaphragm. Such alterations, thereby, reflect abnormalities within the thoracic cavity. The extent and vigor of the excursions of the medical costal margins can be ascertained by placing the thumbs along the medial costal margins with the fingers extending laterally along the ribs, and by exerting slight but firm pressure with the hands and thumb, as shown in figure 2. A decrease in vigor or lag in movement of one medial costal margin indicates that the diaphragm on that side is depressed and has obtained the mechanical advantage over the intercostal muscles. Should the costal margin not move or be pulled in the diaphragm, therefore, has a great advantage over the intercostal muscles because it is depressed greatly. The extent and vigor of excursions of the lateral costal margins are ascertained by placing the extended fingers along the lateral costal margins with exertion of firm and gentle pressure as shown in figure 3. Normally they move outward with vigor and should the lateral costal margins not move outward or should they pull inward.

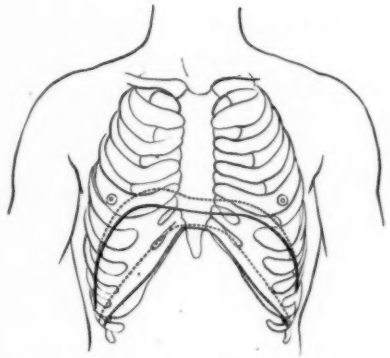

Figure 4. The relationship of the diaphragms and costal margins shown diagramatically.

the diaphragm has been pushed downward and has the mechanical advantage over the intercostal muscles. If, on the other hand, the costal margins flare, or the movement is greater than normally, the reverse alteration in the relationship has occurred. Such an alteration indicates that the diaphragm has become elevated. A diagramatic representation of the relationship of the diaphragm and costal margins in a normal person is shown in figure 4. Depression of the right diaphragm by fluid in the pleural cavity is shown diagrmatically in figure 5. This alteration produces a decrease in the extent and vigor of the excursions of the medial and lateral costal margins on the right side. An elevation of the right diaphragm is shown diagramatically in figure 6, and in such a case the right medial and lateral costal margins would flare or move more than normally. These two conditions can be differentiated easily by ascertaining the above alterations of thoracic excursions.

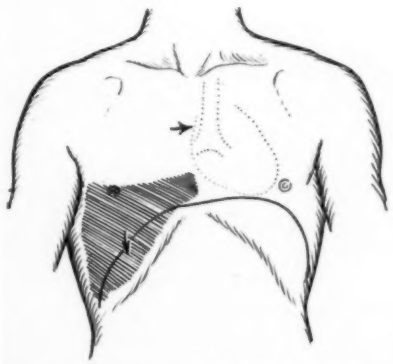

Figure 5. Depression of the right diaphragm by fluid in the right pleural cavity and decreased excursions of the costal margins are shown diagramatically.

Percussion of the lungs was described by Auenbrugger and the mediate method produces a more sonorous note. This is the preferable method to ascertain the pitch and quality of the percussion note of the lung. The immediate method, on the other hand, is the preferable method to obtain borders or changes in relative density. The immediate method is obtained by stretching the skin and subcutaneous tissue tightly over the chest wall and striking the chest wall over this area with a penetrating, dampening blow with the terminal portion of one finger. Immediate percussion is employed usually to ascertain the height of the diaphragms, cardiac borders, width or displacement of the mediastinum, borders of fluid or consolidation. Lack of training and experience with this method of percussion causes many a physician to miss

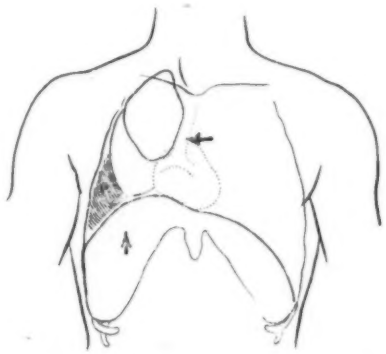

Figure 6. Elevation of the right diaphragm due to atelectasis of the right lung with flareing of the right costal margins are shown diagramatically.

a displaced mediastinum, widened mediastinum, enlarged heart and other alterations of borders within the thoracic cage, and, therefore, to interpretate erroneously the other subjective and objective manifestations.

Immediate auscultation was emphasized by Hippocrates and employed through the centuries until Laennec invented the stethoscope and since that time mediate auscultation has gradually replaced the immediate method. Immediate auscultation should not be discarded. It has its place in the physical examination of the patient and cannot be replaced by any other known method at the present time. In cases of pleural effusion the breath sounds may be completely obliterated by the mediate method, but distant bronchial breathing may be elicited by the im-

mediate method. In instances of deep consolidation and in abscess of the lung the immediate method of auscultation may be of invaluable aid.

Mediate ausculatation is preferable to ascertain the presence or absence of adventitious sounds such as rales. These adventitious sounds, however, may not be elicited in instances of diffuse or localized bronchitis or in cases of early parenchymatous pulmonary lesions until after a few light, but deep coughs. In addition, the characteristic wheeze of partial bronchial obstruction may not be elicited until after such coughs. Such coughing should not be too long or too vigorous. If so, the rales may not persist for a sufficient period to permit detection.

## SUMMARY

Adequate and proper physical examination of the lungs is rapidly being replaced by roentgenograms of the chest.

The main deficiency in the physical examination of the lungs concerns itself chiefly with lack of information regarding the different excursions of the thoracic cage and the abnormalities which may produce alterations of the excursions, and with inadequate information regarding immediate percussion and immediate auscultation.

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# THE CARE OF THORACIC INJURIES*

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BASED primarily on the experience of many surgeons in the recent war, the care of thoracic injuries has now become more standardized than before[1].

Discussion will be limited to those aspects of care which are most commonly utilized in the treatment of civilian-type (closed) injuries. It must be emphasized from the start that early thoracotomy is almost never advisable in civilian injuries. Excepting rare, specific indications, more harm than good will result from immediate operation.

In its broad outlines, proper therapy is based upon one's ability to correct disturbances in cardiorespiratory physiology resulting from pain, anoxia, excessive secretions in the bronchial tree, (traumatic wet lung), hemopneumothorax, pressure pneumothorax, severe hemorrhage, and rarely, cardiac trauma and mediastinal emphysema. Many of the procedures to be described necessarily are carried out almost simultaneously[2].

In most thoracic injuries clinical shock is predominately due to impaired cardiorespiratory function and not to loss of blood. Re-establishment of a normal cardiorespiratory balance usually will correct shock without recourse to intravenous fluids. When hemorrhage is a factor the immediate replacement therapy should be with blood rather than with crystalloids.

*Presented at the Annual Meeting, Arizona Chapter, American College of Chest Physicians, Tucson, Arizona, May 6, 1947.

## THORACIC PAIN

Pain is associated with every *type* and *degree* of thoracic injury. Severe pain plays an important role in the perpetuation of shock. The prompt relief of incapacitating pain becomes, therefore, a vital necessity.

In the past, adhesive strapping has been the most frequently used means of attempting to control pain. Regardless of how applied, strapping has frequently increased discomfort and is essentially unphysiologic. The thoracic cage is compressed and respiratory excursion limited. The efficiency of the cough is reduced which favors the retention of excessive bronhcial secretions. Adhesive strapping is now reserved almost solely for patients with multiple anterior and posterior rib fractures who exhibit "flail" chest and paradoxical respirations.

Morphine and codein in large amounts are expressly contraindicated for the control of pain (Figure 1). Respirations are depressed and the cough reflex is dulled. Retention of bronchopulmonary secretions and severe anoxia frequently follow.

Intercostal nerve block has emerged as the sine qua non in the treatment of thoracic pain[3]. It can be performed regionally, paravertebrally (usually including injection of the sympathetic chain), or locally, at the site of fractured ribs. In my experience a regional block produced at the angles of the ribs has been the most convenient and the most effective. In planning the

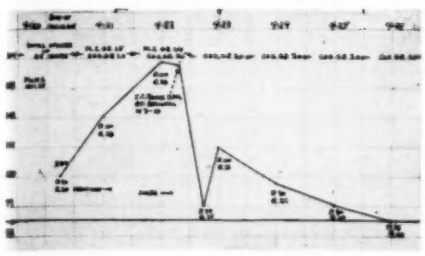


Figure 1. Graph illustrating the clinical course of a man, aged 65, who suffered a "steering-wheel" injury of the right chest. There were multiple anterolatera lrib fractures and severe traumatic wet lung. No hemothorax. Note the ill-advised use of large amounts of opiates during the first two days for the control of pain. Illuminating abstracts from nurse's notes: 4-20 "Breathing difficult—cannot cough;" 4-21 "Intermittant cyanosis—severe pain in chest—respiration gasping"; 4-22 "Confused—apprehensive—gurgling respirations. 8 p.m. Intercostal nerve block on right, patient coughed and raised 2-3oz. of purulent blood-tinged sputum—patient dozing—pulse good quality"; 4-23 "Cough productive—slight recurrence of chest pain"; 4-24 "Pulse good quality—greatly improved"; 4-24 "Cough productive of thick yellow material"; 4-25 "Cough productive, raises clear tenacious mucus." This patient recovered completely.

injection the area of skin tenderness is outlined and an additional two nerves above and below the painful area are injected. There is never any hesitancy in injecting ten or eleven nerves on one side or bilaterally. In nearly all instances the pain relieving effects of nerve block have lasted for at least 24 hours; often only one injection has been needed for permanent relief. Obviously nerve blocks are repeated as often as necessary but in no instances have more than three separate blocks been required.

Intercostal nerve block is best performed with the patient in the lateral recumbent position and the scapula well forward. One per cent procaine solution is employed and 5 c.c. are injected into each nerve. A small wheal is raised over the midpoint of each rib at its angle. Following this, a slightly larger injection needle with the bevel faced cephalad is inserted to the rib, then redirected until the point just clears the inferior margin of the same rib. The needle is then advanced 0.5 cm. and if aspiration is negative for blood the procaine solution is injected.

## EXCESSIVS BRONCHOPULMONARY FLUIDS
### (Traumatic Wet Lung)

Thoracic injury frequently results in the development of increased fluids in the tracheobronchial tree[4, 5, 6]. They may be so small in amount as to be unrecognizable, or so excessive that death may ensue unless the situation is recognized and corrected (Figure 2). The fluids may be composed of blood from pulmonary contusion; tenacious mucus, the result of increased bronchosecretory activity; purulent exudate from a pre-existing or developing bronchitis; and transudate (edema) fluid.

The signs and symptoms of a full-blown wet lung must not be ignored. The patient is dyspneic, often apprehensive. He has a harrassing, wet, painful cough. The cough is non-effectual in that only small amounts of sputum are raised and the bubbling character of the respirations persist. The fact that the cough is continual, even though slightly productive, is pathognomonic of inadequate bronchial drainage. Oral wheezes are prominent and rhonchi are heard constantly over one or both sides of the chest.

The aim of treatment is to improve bronchopulmonary drainage. Proposed surgery must await the establishment and maintenance of an open airway. Thoracic pain is relieved by nerve block and voluntary cough is urged. These may be the only measures necessary (Figure 1). Mechanical suction is resorted to without delay if signs persist. Either tracheobronchial catheter aspiration or bronchoscopy is employed. The equipment for the former is simple and the technique should be mastered without difficulty[7, 8] (Figure 3). Catheter aspiration can be used as often as is necessary. Bronchoscopy is reserved for patients in whom catheter aspiration does not give relief or in whom there are signs of massive atelectasis. It has been performed twice daily without ill effect.

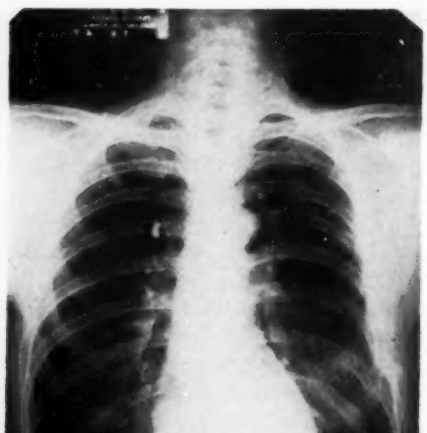
Oxygen should be administered *before* cyanosis develops, if there are early symptoms of anoxia (extreme restlessness, apprehension, dyspnea, or sustained rapid pulse).

## HEMOTHORAX

Hemothorax and hemopneumothorax are the most common complications of thoracic injury. Prior to the war there was much diversity of opinion as to treatment. We now commence aspirations early and continue them daily as long as one hundred c.c. or more of fluid can be obtained. Aspirations should be undertaken within a few hours of injury if the collection of fluid embarrasses respiration. In an emergency this blood may be used as an autotransfusion. Air

replacement is *not* employed. One thousand c.c. of blood and air usually can be removed without danger at a single aspiration. Thoracentesis should be stopped if the patient becomes faint, dizzy, complains of a tight chest, or commences to cough violently. If these signs develop after the removal of only three hundred or four hundred c.c., it is highly suggestive that *pulmonary atelectasis is present.*

A B




C

Figure 2. A. Portable film, day of injury, male, aged 58. There are bilateral pulmonary contusion, small left-sided hemothorax, rib fractures 3 to 9 inclusive on the left, and fractures of the 4th, 5th, and 6th ribs on the right.

B. Portable film, 9 days later. Still critically ill and confused most of the time in spite of intensive therapy. There are now bilateral suppurative bronchopneumonitis; left-sided hemothorax; right-sided hemopneumothorax. Rapid recovery shortly after this date. Patient discharged from hospital 13 days later. During one week's time the following therapy was given: Intercostal nerve block, left; thoracentesis, left; thoracentesis, right, three times; tracheobronchial catheter aspirations, 15 times; bronchoscopy, blood transfusion, 3 times. No other combination of therapy would have cured this individual. A suggestion by the referring physician that early surgery should be done during this period to "wire" the fractured ribs was not considered. The fractured ribs were **not** causing the patient's difficulties and surgery would have resulted fatally.

C. Roentgenogram 6 months following injury. The fractures healed well **without** recourse to surgery.

Air is likewise aspirated as found. Occasionally all blood may be aspirated and a "residual" pneumothorax remains, due to a small continuing air-leak. If, on two successive aspirations, large amounts of air are removed without re-expanding the lung, further procedures may be necessary. An intercostal catheter is introduced into the space and attached to a water-seal drainage bottle. This is consistently effective in rapidly overcoming a residual pneumothorax (Figure 4).

It is true that in many instances no harm has resulted from a residual pneumothorax of some days' or weeks'' duration. It is always preferable, however, to re-expand the lung and obliterate the pleural space as rapidly as possible.

## PRESSURE PNEUMOTHORAX

While infrequent, this complication may be fatal if unrecognized. The most frequent cause is a pulmonary laceration in which the bronchial opening acts as a check valve. During inspiration gradually increasing amounts of air are trapped in the pleural cavity. The diagnosis is based on the findings of dyspnea, a hyperresonant hemothorax, absent breath sounds and a shift of the heart and mediastinum to the opposite side. In the purely emergency treatment of pressure pneumothorax a large-bore needle should be plunged into an upper anterior intercostal space and attached to a water-trap bottle. The needle should not be left indwelling more

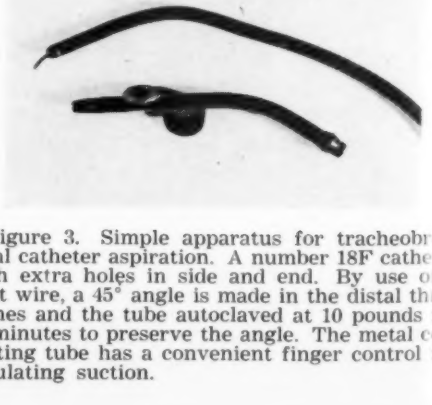
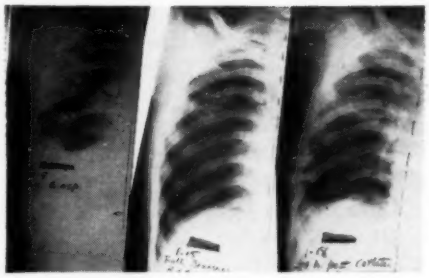


Figure 3. Simple apparatus for tracheobronchial catheter aspiration. A number 18F catheter with extra holes in side and end. By use of a bent wire, a 45° angle is made in the distal three inches and the tube autoclaved at 10 pounds for 10 minutes to preserve the angle. The metal connecting tube has a convenient finger control for regulating suction.



A B C

Figure 4. A. Penetrating gunshot wound of chest and vertebra. Paralysis of lower extremities. Laminectomy with slow partial recovery from paralysis. Intercostal nerve block and two thoracenteses have preceded this roentgenogram. The patient is coughing poorly. There is atelectasis of right middle lobe and persisting hemopneumothorax.

B. Six days later. A bronchoscopy and two additional thoracenteses have been performed. The lung is clear but the residual pneumothorax has increased.

C. Twenty-four hours after the introduction of an intercostal Pezzar catheter. The lung promptly and permanently re-expanded.

than a few hours. If air continues to bubble through the water-trap system or, if examination shows that the lung is not expanding, a number 18F or 20F catheter is to be substituted for the needle and attached to a water seal. A Malecot or Pezzar catheter can be used for this purpose. The lung will expand only if the caliber of the drain is larger than the caliber of the bronchial opening; frequently the catheter will be successful in controlling pressure pneumothorax when a needle has failed.

If, after twenty-four hours, the lung has not commenced to re-expand, surgery should be performed to repair a probable laceration in a large bronchus or the mediastinal trachea.

## MEDIASTINAL EMPHYSEMA

This complication rarely causes mediastinal pressure and is usually of no clinical significance. Frequently the supposed pressure symptoms from mediastinal emphysema are due to a concomitant pressure pneumothorax which should be controlled as described above. Suprasternal incisions into the deep fascial planes rarely may be necessary as an emergency measure to relieve pressure within the mediastinum.

## CARDIAC INJURIES

Cardiac injuries may be of two kinds. The heart may suffer an actual penetrating or perforating wound from stabbing or from a bullet. Cardiac tamponade frequently accompanies civilian cardiac wounds although it was rare, following war wounds. If tamponade develops slowly it often can be controlled by aspiration. Should symptoms of pressure recur surgery will be necessary.

The second type of cardiac injury is probably more common than is realized (Figure 5). It is a cardiac contusion, typically the result of the so-called "steering-wheel" injury. The symptoms are those primarily of cardiac dysfunction: rapid pulse; irregularities of rhythm; occasional bradycardia; and continued shock, out of proportion to the amount of obvious injury. Pericardial fluid may accompany such injuries. If a diagnosis is suspected, confirmation can be obtained by electrocardiographic studies.

Such injuries are serious and the patient should be treated as if he had a coronary occlusion.

## SEVERE INTRATHORACIC HEMORRHAGE

In the presence of severe continuing hemorrhage early operation is necessary. Diagnosis is not always easy to make. As indicated above, early thoracotomy usually will do more harm than good unless specific indications exist. The presence of from 1000 to 1500 c.c. of bloody fluid in the pleural cavity a few hours after injury does not, in itself, indicate life endangering hemorrhage. Severe hemorrhage from the pulmonary parenchyma or from intercostal vessels is exceedingly rare. The following criteria have been the most reliable guides to serious continued hemorrhage: (1) A blood pressure which

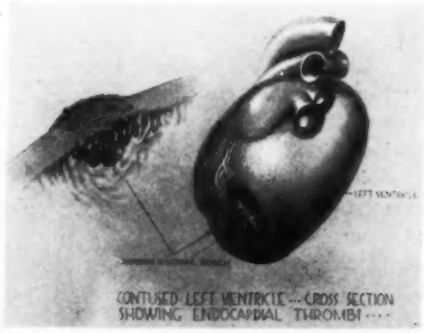



Figure 5. Severe myocardial contusion and endocardial mural thrombi accompanying a tangential sucking wound of the anterior left chest. The pericardium was intact. Continued dyspnea, cyanosis and sustained rapid pulse out of proportion to the extent of the visible injury. Cardiac death, 17 hours after wounding.

fails to rise with apparent adequate blood transfusion as high as 2000 c.c. or having risen to relatively normal levels, falls again; (2) Re-accumulation of from 1500 to 2000 c.c. of blood in the pleural cavity within 24 hours of the initial aspiration of a similar large amount; (3) Persisting severe anemia in spite of blood replacement, as determined by serial hematocrit reading.

## SURGERY IN THORACIC INJURIES

Early surgery is almost never indicated in patients suffering from the usual type of civilian thoracic injury. Even patients with extensive fractures of ribs should not be subjected to early open operation. Stab wounds and small-caliber gun shot wounds are seen but the wound, per se, does not make thoracotomy necessary although it may be associated with a large hemothorax or extensive pulmonary contusion. The lung, in particular, has remarkable recuperative powers and early lobectomy or pneumonectomy is almost always ill-advised.

Whether due to wound or injury there are but rare specific indications for early exploration: Severe continuing hemorrhage; wounds of the heart with early or repeated tamponade; esophageal lacerations; tears of trachea or large bronchi; suspected thoraco-abdominal involvement. Regarding the latter indication, space does not permit full discussion. The approach may be abdominal or thoracic depending upon the location and extent of the damage in the two cavities. The development of a "flail" chest from multiple anterior and posterior fractures may necessitate some type of operative immobilization although most of these can be stabilized by adhesive strapping. Depressed or mobile fractures of the sternum may need early surgical correction. Rarely, one may see sucking wounds or partial avulsions of the thoracic wall caused by the discharge of a shotgun. These must be debrided widely and a layered closure performed following the dicta established during the war.

*Delayed* surgery (from weeks to months after surgery) may be indicated to correct post-traumatic complications. On two occasions I have operated because fractured rib-ends continued to cause pain and pleural irritation after several months. In both, the fractured stumps were removed subperiosteally rather than attempting wire stabilization. Occasionally persisting or developing intercostal nerve pain due to scar or irregular periosteal bone formation may require neurolysis or neurectomy.

A residual pneumothorax may persist indicating the presence of a permanent bronchial fistula. Open operation should be performed after suitable conservative measures have been tried. The fistula may be excised or a wedge resection of damaged lung performed.

Foreign bodies larger than 1.5 cm. in diameter probably should be removed from the lung within a week or two of injury and always should be removed from the pleural cavity. Experience shows that foreign bodies in the pleural cavity are associated with a higher incidence of intrapleural infection than are foreign bodies in the lung. Intrathoracic foreign body may be an additional indication for surgery in the presence of a complicated hemothorax.

The bulk of delayed surgery in thoracic injury is concerned in managing the complications of hemothorax: clotting, organization, and infection. It is now known that blood clots frequently in the pleural cavity. In many patients this has had little clinical significance since the clots have been removed by thoracentesis, or absorption hastened by breathing exercises[9]. In an appreciable percentage, however, the blood cannot be aspirated. The intrapleural infection rate is higher in these cases and organization frequently takes place.

Hemo-organization is the phenomenon of proliferation of fibroblasts and angioblasts into the clot from the visceral and parietal pleural surfaces. The organization progresses with eventual formation of a firm peel or fibroblastic membrane which may reach the thickness of a centimeter or greater. The outer or older aspect (that adherent to the pleural surfaces) eventually becomes composed of adult fibrous tissue. It is of extreme importance to recognize that in these cases *there is no thickening of the visceral pleura* (Figure 6).

Recognition of the pathology of hemo-organization has been of great importance in the re-evaluation and re-employment of pulmonary decortication. In cases of uninfected, organizing hemothorax, this operation is employed from four to six weeks following injury when roentgenograms show a generalized hazy chest or when the patient exhibits retraction of intercostal spaces, poor expansion, diffuse thoracic pain, or dyspnea. Without operation, these patients

develop chronic fibrothorax and become permanent pulmonary cripples.

Infection may develop in a hemothorax at any time. The infection rate is increased in the group of clotted hemothoraces and is likewise higher in any group of hemothorax cases which are not aspirated promptly and vigorously. Rapid re-expansion of the lung is the best insurance against the development of empyema. Recognition of this principle was, in large measure, responsible for the drop in infection rate for hemothorax in the Mediterranean Theater from an early figure of approximately 25 per cent, to 7 per cent during the last six months of the war.

The management of infected hemothorax and hemothoracic empyema depends on the condition of the lung, the size of the pocket and the general condition of the patient. If the upper portion of the lung is well expanded and the infected hemothorax is basal, aspirations and instillation of penicillin are continued for a short period of time, followed by dependent air-tight rib resection drainage. Often this operation is performed before a gross empyema becomes apparent. When the infected hemothorax is large, with total or apical collapse of the lung, early decortication is performed, occasionally within two weeks of injury. It is known that the essential pathogenesis of hemo-organization is not changed by the presence of infection and that the same general type of peel is present. There is evidence, however, that the speed of organization is increased if early infection develops. It can be seen, therefore, that decortication is now

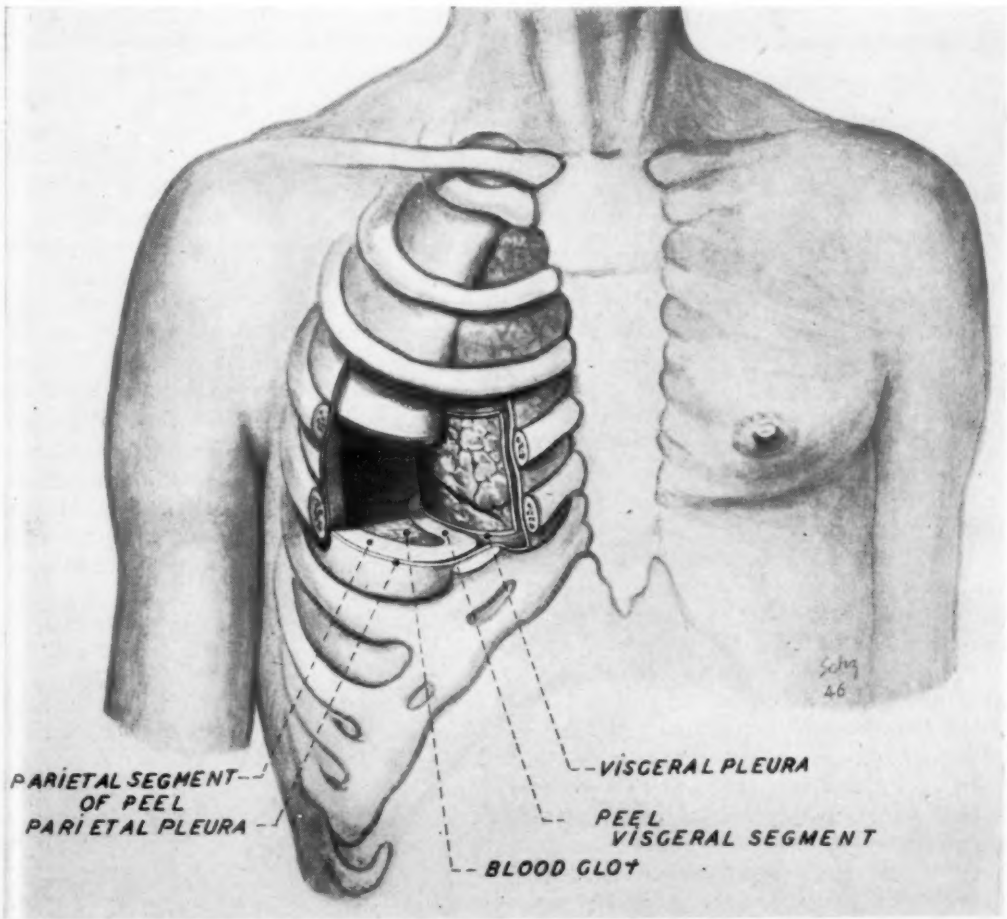



Figure 6. Semi-shematic transparency showing relationship of an organizing hemothorax (closed intrapleural hematoma) to the collapsed right lung (Reprinted from the Journal of Thoracic Surgery (12).

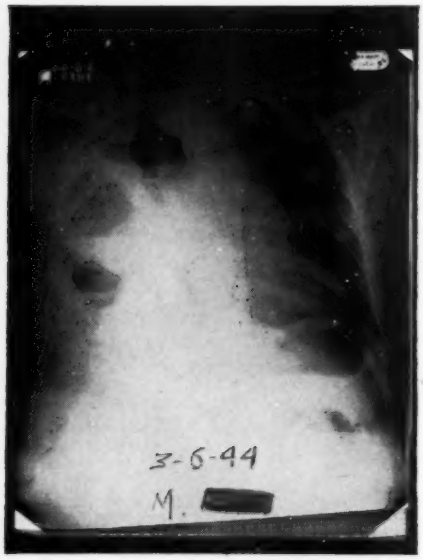



Figure 7. Roentgenogram taken 14 days after wounding. The lung is subtotally collapsed by an organizing, infected multilocular hemopneumothorax (hemothoracic empyema). Patient critically ill. Subsequent daily aspirations with instillation of penicillin. Repeated blood transfusions. Thoracotomy 28 days after wounding: Decortication with complete pulmonary mobilization and large wedge resection of peripheral portion of necrotic and fistulous lower lobe.

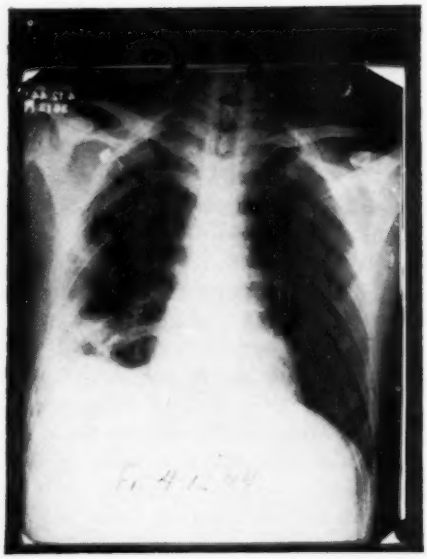


Figure 8. Twenty-three days following decortication. The lung is completely re-expanded. There is no residual empyema. Cure.

considered to be much more applicable to the acute or subacute, rather than to the chronic phases of empyema (Figure 7).

If the operation is done properly excellent results can be expected. From 75 to 90 per cent of patients may look forward to complete re-expansion of the lung and primary cure without a recurrence of the empyema (Figure 8). Pathology in the lung requiring closure or wedge resection (hematomas, bronchial fistulae, or infected sinus tracks) will lower the percentage of primary cures. Even with the recurrence of a basal empyema, however, the patient is much better than before and the small residual empyemas can be treated successfully by rib resection.

Decortication usually is performed through a posterolateral thoracotomy. On entering the pleural cavity all fibrin, pus, and clots are removed, leaving a pebbly reddish-brown surface behind (Figure 9). This is the inner or younger aspect of the peel. Sharp incision is made through the peel down to the visceral pleura. With slight positive pressure the lung herniates through the peel (Figure 10). It should be re-emphasized that in all cases the peel or fibrous membrane overlies the pleura, the pleura itself being normally thin and translucent. Once the cleavage plane is established, the peel is removed by combined sharp and blunt resection from the surface of the lung. The fissures, the diaphragm, and the mediastinum are completely separated down to the hilum so that complete circumferential freeing can be gained. The peel is removed to its reflection onto the inner thoracic wall and usually no attempts are made to decorticate the parietal pleura[10, 11, 12].

Two intercostal water-seal drains are always employed, one tube in the 8th intercostal space posterolaterally and one in the 1st or 2nd intercostal space anteriorly. Penicillin is used intra-

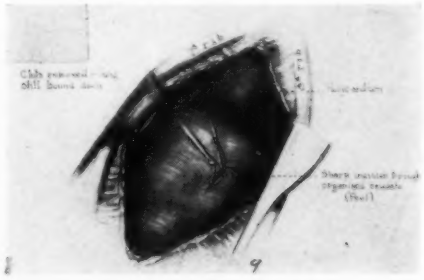


Figure 9. Drawing at operation after removal of blood clot, fibrin and pus. Method is shown of establishing cleavage plane by sharp incision through peel. (Reprinted from the Journal of Thoracic Surgery (12).

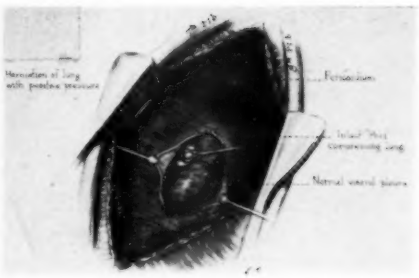


Figure 10. With application of positive pressure the lung bulges through the incision in the peel. Visceral pleura is normal. Actual decortication is begun using gauze or finger dissection. (Reprinted from the Journal of Thoracic Surgery (12).

pleurally and in severe mixed infections both penicillin and crystalline sulfanilimide are placed in the pleural cavity. The lower tube is clamped off for six hours to allow for time contact with the basteriostatic agent and the upper tube is connected immediately to a water-trap bottle to permit rapid re-expansion. Layered closure with fine silk is performed and intercostal nerve block is used to control the immediate postoperative pain. If the patient is at all "wet" during surgery he is bronchoscoped at the end of operation.

## SUMMARY

1. The importance of recognizing factors responsible for disturbed cardiorespiratory physiology in thoracic injuries has been stressed.

2. The symptoms and treatment of thoracic pain, anoxia, traumatic wet lung, hemothorax, and pressure pneumothorax have been presented.

3. The "Therapeutic Triad" most commonly employed for improving thoracic dysfunction has been given: Intercostal nerve block for the control of pain; thoracentesis or water-trap catheter drainage for intrapleural pathological changes; mechanical suction (catheter aspiration, bronchoscopy) for the removal of excessive bronchial fluids.

4. It has been emphasized that there are but rare specific indications for early surgery in thoracic injuries.

5. Delayed surgery for the complications of thoracic injuries has been discussed.

6. The modern application of decortication has been described.

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# THROMBOSIS OF AXILLARY AND SUBCLAVIAN VEINS

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THE purpose of this paper is to give a brief review of the literature and to cite a case of thrombosis of the axillary vein.

Both the foreign and American medical literature have reported relatively few cases. In 1937 Kaplan and Katz[10] could find approximately 120 cases in a rather extensive search through the literature and in 1940 J. R. Veal[5] found 30 more. However, it may be more common, as usually only one case is encountered and these isolated ones might not be reported. Recent literature has added others, but still no large series have been reported. Sir James Paget described this entity in 1873 and the first reported case was that of Von Schotter in 1884. Apparently, no further references appeared in the literature until 1911, when 70 cases were reported, all with a uniform picture[8].

The symptom complex of swelling of the arm and shoulder has, for the etiologic basis, a variable factor; in fact, writers give three possible reasons in regard to the etiology. Matas[6], in an excellent discussion of the syndrome, has pointed out that infection may play a part as some of the thrombi that have been removed have shown, after culture, Streptococcus viridans, Staphlococcus albus and other forms of streptococci. Pathologically this has been found to be a septic phlebitis which has produced actual changes in the vessel wall. However, this basis is perhaps the least of all in the matter of importance and falls into the picture of thrombophlebitis.

Also, a sympathetic theory has been considered; the lesions have been thought to be produced by venospasm which was induced by sympathetic irritation caused by the trauma. This sympathetic irritation apparently arises as an effect of vasomotor reflexes which are found in the perivenous sympathetics. Mere obstruction of the vessel lumen is not the only cause of edema, but it is the persistant irritation of an inflamed or injured perivenous plexus in the vein wall that is responsible for the rapid edematous swelling. It has been found that with section of the vessel or removal of the clot the vasomotor equilibrium is restored with subsequent vasodilitation and disappearance of the edema.

The third factor, that of trauma, is perhaps the most generally accepted one, especially in view of the experimental evidence and also from the histories of cases. It has long been felt that the act of trauma to the subclavian vein due to sudden action of the arm is the initiating cause. Because of this, Gould and Patey[11] injected plaster of Paris into the axillary veins of cadavers with the arm being in the abducted position. In two cases they observed deep grooves corresponding in one to the pressure of the subclavius muscle and in the other, a shallow groove corresponding to the costo-coracoid ligament. These two also demonstrated a competent bicuspid valve in the vein which was situated at the level of the subclavius muscle. This valve was found to be so placed, that the pressure of the muscle stretched the wall of the vein in its long axis. Theorizing, they felt that it was the subclavius muscle which is responsible for the trauma to the vein and that as a result of this trauma the valve is ruptured. They also feel that this ruptur is the fundamental basis for the formation of the thrombus. Others[3-11] have advanced theories substantiated by experimental and clinical studies which are all similar in that it is believed[3] that trauma is the prime factor whether it produce compression, stretching or distension of the vein and then compression. Sampson[7] feels that body build and posture associated with broad, horizontally curving first ribs and posteriorly directed clavicles predisposes to this condition. He also states that chronic compression of the subclavian vein may evntually produce thrombosis.

In spite of the vast majority of cases that give trauma as occurring immediately or at some previous time, there have been a few cases[1] in which no traumatic history could be elicited. Dittman and Walker believe that trauma is the "trigger mechanism" for the induction of this symptom complex[1, 2].

The symptoms are rather striking and seem to be usually rather uniform. Venous thrombosis

is most frequently found in a young, healthy and active male who has had no antecedent history of injury. Except for a few cases there is a history of strain, either small or large, and usually in the right arm, particularly in right handed individuals, and usually the working class. The person then experiences pain[5] and a swelling of the arm, which may come on immediately or within a few days. This swelling involves the entire arm and is not accompanied by fever or increased local temperature[6]. The radial pul e is preserved, but there is a weakness and some loss of function of the arm due to the massive edema. Some feel that there is a definite rise in the blood pressure of this arm, but others have failed to find this consistently[3]. A lividity usually accompanies the symptom complex and also on palpation there is a cord-like swelling along the brachial, basilic and axillary veins. As would be suspected, the venous pressure is markedly elevated. There is sometimes visible collateral circulation seen over the veins of the upper extremity and chest, and with infra-red photography this is even more clearly demonstrated[5-10]. It has been found that the circulation time—extermity to tongue—is prolonged[8]. All these symptoms may last from several days to several months, depending on the severity of the involvement present. One case has been reported to have receded in six months.

Diagnosis is usually self evident. Direct x-ray visualization by diodrast has been used both as for diagnostic purposes and also to determine the feasibility of operative removal[4, 12].

Treatment resolves itself into palliative or surgical. Most cases respond to simple rest, elevation and immobilization. Massage later has been advocated for the promotion of collateral circulation. The use of the anti-coagulants has not been found in the literature. Surgical intervention must be considered if the palliative treatment does not give relief and thrombectomy and excision of the thrombotic segments have been advocated. The latter seems to be advantageous, particularly when venospasm is present.

## CASE REPORT

The patient, L. J. W., aged 21, entered the office on the 3rd of January, 1941, stating that he had had influenza on December 13-18, 1940 and was in bed at that time, but that he apparently recovered from this illness. On January 1, 1941 he was cranking a light gas engine and later on in the day he first began to feel as if there were something wrong with the right arm. He had no pain but there was a sensation of fullness in his arm. The next morning the whole right arm was swollen, including the right shoulder, and then there was first noted some numbness in the arm and a throbbing pain in the right shoulder. The skin seemed to be red and hot and there was difficulty in moving the arm. The past history and the family history failed to reveal any pertinent findings.

Physical examination revealed a well developed, well nourished, white male of approximately the stated age. He did not appear acutely ill, although he seemed to be in some discomfort, particularly with the right arm. Physical examination: the heart revealed no significant murmurs; the blood pressure was 128/75; the pulse 70 bilaterally. There was slight impulse at the left internal ring. Examination of the upper extremities revealed that the entire upper right extremity and shoulder were swollen. The skin was injected until it was a dusky red; the arm felt tense and there was no pitting of the tissues. There was some venous engorgement noted around the shoulder and it was felt that the axillary vein was palpable and felt cord-like. Venous pressure was done by the direct method and it was impossible to obtain any reading as the pressure was above what the instrument could record. This and the following venous pressure are recorded in Table I. Measurements of the arm were taken and subsequently are noted in Table II.

TABLE I

| Date | Venous Pressure |
|---|---|
| 1- 3-41 | Not recordable as pressure was too high for instrument. |
| 1-11-41 | 30 |
| 1-19-41 | 21 |
| 1-26-41 | 16 |
| 2- 3-41 | 16 |
| 7-14-41 | 14 |
| 3-14-46 | 19.2 right, 16 left. |

TABLE II

| Date | 1-3-41 | | 1-2 41 | | 3-3-41 | | 7-10-41 | |
|---|---|---|---|---|---|---|---|---|
| | Right | Left | Right | Left | Right | Left | Right | Left |
| Biceps | 11¾ | 10 | 10½ | 10 | 10 | 10 | 10¾ | 10¼ |
| Forearm | 10¾ | 10 | 9¼ | 9 | 9 | 9 | 10 | 10 |
| Wrist | 6¾ | 6½ | 6½ | 6½ | 6½ | 6½ | 6⅝ | 6½ |

The patient was hospitalized, where the physical examination was essentially as given. Laboratory examinations done at the hospital were normal, including a Kahn and Wasserman. A portable chest film failed to reveal any abnormal findings.

The arm was immobilized and the patient was kept at complete bed rest. The following day it was felt that the arm showed a slight increase of the edema and the patient complaining of more numbness of the arm and shoulder. It was decided to try heparin and he was given a total of 5 c.c. intravenously, but shortly after he began to have a sinking feeling and a sensation of vertigo. The patient complained of palpitation of the heart and the pulse rate seemed very high. Blood pressure at the time was 140/80 and the pulse was 90. It was believed that the occurrence of these symptoms, which developed with the use of heparin, were probably a reaction from the heparin, consequently no heparin was used after this.

In a period of approximately eight days there was noted definite improvement in the arm and the skin seemed less tense. Venous pressure was taken on this day and the results can be found in Table I.

The only physio-therapy used during this time was infra-red rays.

The patient had continued improvement and after approximately one month he was discharged from the hospital. He was seen one month later when he complained of the right arm feeling heavy and that his hand was cold. He was cautioned about using the arm too much. One month after this he was again seen and he stated he had tried to do some work with the right arm, but noticed some swelling, which immediately receded after exercise was stopped. There was no pain and the blood pressure was 135/80 in the right arm. The patient was seen at intervals during this period of time and he had very little complaint as far as the arm was concerned. He obtained a job doing typewriter repair work and although he had no difficulty using the arm, it did tire more easily than formerly and he noticed an occasional cramping in the right arm.

In December, 1942 the patient entered the service and he noted that his arm seemed to bother him in basic training, particularly with bayonet practice and extended drill. Because of his previous history of thrombosis he had x-rays with diodrast at Kessler Field which apparently failed to reveal any abnormal findings. He noticed that extreme use of the arm seemed to cause a slight pain, but other than this he had no further symptoms. He served in the China, Burma, India and the Southwest Pacific theaters for two years and after his return to this country and subsequent discharge from the service he has again been following the vocation of typewriter mechanic and he has had no further return of symptoms.

## SUMMARY

A short review of the literature on venous thrombosis is given and a case is presented.

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# THE ROLE OF POTASSIUM CHLORIDE IN ELECTROLYTE REPLACEMENT

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THE recent brilliant and convincing studies of Darrow of Yale University and of Govan of Johns Hopkins University, have demonstrated the value of potassium in the treatment of dehydration resulting from diarrhea. A new plan for the treatment of diarrhea in infants is described, opening a bright and hopeful vista in the concept of the physio-pathology and providing us with a potent weapon in combating this perplexing problem.

Darrow has disproved irrevocably the previously prevailing concept that the loss of intracellular water and electrolyte occasioned by diarrhea was not readily reversible. From the data accumulated in Darrow's meticulously conducted metabolic-balance studies, the following conclusions were drawn:

1. Diarrhea resulted in a decrease in extracellular water, due to the loss of sodium and chloride from the extracellular fluid.

2. In some cases, a large part of the loss of extracellular sodium was explained by the transfer of sodium from the extracellular to the intracellular fluids;

In other cases, the sodium was lost from both the intracellular and extracellular fluids.

3. A prominent feature in all cases was the loss of intracellular potassium.

4. The loss of potassium was greater than would be expected from the loss of nitrogen occasioned by cellular break-down.

5. Correction of extracellular losses of water, sodium and chloride was accomplished by the usual therapeutic measures of fasting and parenteral administration of solutions containing sodium chloride, sodium lactate and dextrose. In two cases, however, the loss of potassium was aggravated by sodium entering the cells. It is now known that the prolonged administration of dextrose and saline solutions will cause potassium to be lost from muscle cells and be replaced by equivalent amounts of sodium.

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6. Losses of intracellular potassium were partially corrected, during the fasting stage of treatment, by parenteral use of potassium chloride-sodium chloride-r-lactate solution. Later, during the stage of submaintenance feeding, further replacement of intracellular potassium was accomplished by adding 1 to 2 grams of potassium chloride to the daily oral feeding.

7. Accompanying this replenishment of both intracellular and extracellular electrolyte, the babies looked better than after the usual type of treatment and recovered from attacks of diarrhea that would usually be fatal.

8. The loss of nitrogen was rapidly restored as soon as milk was given even at a low caloric intake.

Darrow's studies demonstrated that the magnitude of the loss of body potassium was equivalent to about one-quarter of the estimated body potassium in the most severe cases, and that this loss could be effectively corrected without food. Earlier workers, as early as 1850, observed that loss of potassium occurs in cases of diarrhea. These were: Schmidt in 1850, Meyer in 1903, Tabler in 1910, Jundell in 1913, and Holt in 1915. However, these earlier observers failed to employ potassium salts parenterally because they feared the possible toxic effects of potassium administered in this manner, or they despaired that the loss of potassium was evidence of some fundamental, intracellular change which was believed to be uncorrectable, because the cell membrane would not permit extracellular potassium to become intracellular.

In the body's chemical economy, potassium is as essential as sodium, residing chiefly in intracellular fluid. 100 c.c. of normal blood contains 440 mgms. of potassium, of which only 20 mgms. are present in the plasma, the remaining 420 mgms. being contained in the red-blood cells. Potassium is an important constituent of muscle cells, and plays an important role in contraction, myosin solubility, and muscle tone. In addition to diarrhea, potassium is lost from muscle cells in a number of other conditions, as in diets of low potassium content, injections of desoxycorticosterone acetate, prolonged administration of dextrose and saline solutions, Cushing's syndrome, refractory alkalosis, cases of familial periodic paralysis and in chronic nephritis, or in aggressive treatment of diabetic acidosis with large amounts of dextrose, insulin and fluid.

## GENERAL OUTLINE OF TREATMENT OF DEHYDRATION OF DIARRHEA IN INFANTS, EMPLOYING POTASSIUM CHLORIDE.

A. *Initial treatment of shock*

On admission to the hospital, all severely ill patients are given an intravenous injection of 10 to 20 c.c. of whole blood or plasma per kilogram of body weight, together with an equal volume of normal saline. This treatment aims at the improvement of the circulation, correction of anuria by initiating urinary output, and the improvement of function of the cellular enzyme systems. In milder cases, only intravenous injections of dextrose and saline solutions are employed in the initial treatment. Vitamin B complex, such as Solu-B, is added to the dextrose and saline solutions, and the patients are given intramuscular injections of crude liver extract in doses of 1 c.c. twice a week.

B. *Period of Fasting*

I Oral administration of food and water was withheld "until all evidence of dehydration was overcome, nausea was no longer manifest, and intestinal functions had been partially restored." No infant is to receive any food or liquid by mouth, for at least the first 24 hours. During this fasting period, all fluids are administered exclusively by slow intravenous drip, often supplemented by subcutaneous injections.

II During the first 24 hours of fasting, replacement of lost body fluids and electrolytes are accomplished by subcutaneous or intravenous injections of a solution consisting of:

Potassium Chloride .....2.0 gm.
Sodium Chloride .....3.0 gm.
Molar Sodium Lactate...40.00 c.c.
Triple distilled water...710.0 c.c.

This solution, which I shall refer to as "Darrow-Govan's Solution," is administered during the first 24 hours in a total dosage of from 80 to 150 c.c. per kilogram of body weight, usually by slow drip over a period of 8 to 12 hours.

III In addition, this administration of Darrow-Govan's solution is supplemented by sufficient 5 per cent solution of dextrose in water intravenously to bring the total 24 hours' fluid intake parenterally up to a volume of from 150 to 280 c.c. per kilogram of body weight.

IV After the first day, smaller amounts of the Darrow-Govan solution (Potassium-Sodium Chloride-Lactate Solution) are given, namely,

from 20 to 50 c.c. per kilogram of body weight. This is also supplemented by the intravenous administration of sufficient 5 per cent dextrose solution to make the total 24-hour intake of from 150 to 200 c.c. per kilogram of body weight. In some cases, equal volumes of the two solution may be mixed together and administered subcutaneously. Supplemental administration of Amigen or other amino-acid solutions may be employed, as are the parenteral vitamin solutions. This total daily dosage is continued as long as the stools remain watery.

C *Oral Feeding*

When all evidence of dehydration has been overcome, and when the stools are no longer watery, oral feeding is begun. The period of fasting required to accomplish this varies from one to six days. On the first day of feeding, the infant is offered 10 calories per kilogram of body weight, and the feeding consists of 2 per cent fat and 5 per cent dextrimaltose; it is made from powdered whole lactic acid milk and powdered skim milk; after sufficient water is added to restore these powdered milks to their original concentrations, equal parts of each of the reconstituted milks form the basis of the food. For most of the patients, the milk is diluted with sufficient water to provide 150 c.c. of fluid per kilogram body weight per day. If the infant does not take this quantity, subcutaneous or intravenous injections of normal saline or 5 per ctnt dextrose are administered.

As long as the infant receives less than 70 calories per kilogram body weight, from 1 to 2 grams of potassium chloride are added to each day's feeding. The milk feedings are gradually increased over a period of from 7 to 14 days until a maintenance diet is reached.

Evaluating the effects of potassium on the mortality rate of diarrheal dehydration—Govan and Darrow offer these figures—a mortality rate of 6 per cent in the group treated with potassium, as compared to a mortality rate of 32 per cent in the group treated by conventional methods. In general, the potassium therapy does not apparently shorten the period of watery diarrhea, but it does enable the babies to withstand a severe or prolonged attack that would otherwise be fatal.

Our own experiences with this type of therapy have been limited, but favorable in the 11 cases we have employed it. Reviewing all admissions of infants with diarrhea under one year of age to the pediatric service of the Yuma General Hospital in the 20-month period between August 3rd, 1945 to April 3, 1947, we note 97 admissions. The ages varied from 3 days to one year, with an average age of 3¼ months. Of these 86 were treated by the conventional methods, including parenteral fluids, plasma or blood transfusions, chemotherapy, biotherapy, various diarrhea correctives, etc. Eleven were treated by the above outlined method, and no fatalities are recorded in the group treated by Darrow-Govan method. In the conventionally treated group, there were 17 deaths. However, four infants were moribund on admission, and two died of complicating conditions, namely, broncho-pneumonia and cerebral embolism, after appearing to be clinically cured of the diarrheal complaint or dehydration. This leaves us a corrected mortality of 11 cases or a mortality rate of 12.8%. In the group treated by conventional methods, recovery required hospitalization of 6.86 days average duration; whereas, in the group treated by the Darrow-Govan method, hospitalization was of 5.45 days average duration. Because laboratory studies were not available, I am unable to present chemical or metabolic statistics; but my colleagues and I have observed a marked and favorable improvement in infants treated by the method outlined by Darrow and Govan.

In employing potassium therapeutically, one must be well aware of the possible toxic effects of this chemical, and be alert for the possibility of potassium poisoning, as cardiac depression and severe heart block with E. K. G. findings of absent P-waves in lead I, pathological T-waves in all leads, low voltage and depressed S-T segments. The first signs of potasisum poisoning are the onset of cyanosis and clinical signs of shock, which result from the slowed circulation secondary to the bradycardia and heart block. Heroic measures are to be employed in providing antidotes for potassium poisoning. These consist of administering calcium intravenously, as well as the intravenous injection of hypertonic dextrose solution. A dose of 10% calcium gluconate solution as large as 15 c.c. may be given slowly intravenously to an infant to counteract the inhibitory effect of potassium on the heart. The dosage is really determined by the effect. Intramuscular injections of calcium are of no value in combating potassium intoxication. The intravenous injection of hypertonic dextrose

solution is given for diuretic purposes, and to accomplish deposition of glycogen. When glycogen is deposited in the liver, potassium accompanies it, thus reducing the potassium concentration in the extracellular fluids.

The contra-indications to the parenteral administration of potassium are:

1. High level of serum potassium.
2. Impaired renal excretion.
3. Pre-existing heart-block.
4. Addison's disease.

Govan and Darrow do not believe that there is a great deal of danger of potassium intoxication following the injection of KCl—NaCl—Lactate Solution if the following precautions are observed:

1. The dose should seldom exceed 80 c.c. per kilogram body weight per day.

2. The rate of injection is determined by the fact that, as a rule, the administration of the total daily dose should be spread over a period of from 8 to 12 hours; a faster rate of administration may, at times, be required, but not less than a period of 4 hours should be allowed.

3. Injection of the solution should not be started unless there is obtained evidence that the kidneys are functioning and readily excreting. This is extremely important.

4. Injection of the solution should not be started until the measures used in treating shock, as whole blood or plasma transfusions, and intravenous injections of normal saline, have produced some recovery of an adequate circulation, and of the functioning of cellular enzyme systems, especially of the liver.

## SUMMARY

The significance of a deficit of potassium in dehydration states accompanying diarrhea in infants is discussed.

Our experience with a new mode of therapy of diarrhea in infants is described, employing the principles of fasting, correction of shock, and the replenishment of lost fluids and electrolytes.

The precautions necessary for the prevention of potassium intoxication are briefly discussed.

380 S. Main St.

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# BAL IN THE TREATMENT OF ARSENIC POISONING

By LOUIS G. JEKEL, M. D.
*Phoenix, Arizona*

BAL, the new drug used in the treatment of intoxication with arsenic and other heavy metals, was used successfully on the patient whose case history is herein reported.

## CASE HISTORY

Mrs. C. entered the hospital for anti-syphilitic treatment. The usual routine of 2,400,000 units of penicillin, five injections of Mapharsen and three injections of Bismuth subsalicylate was prescribed. One injection of Mapharsen, 0.02 gm. was given in the office two days before admission to the hospital.

On the fourth hospital day, after the second hospital injection of Mapharsen the patient complained of headache, stiff neck, swollen, tender cervical lymph glands, chills and fever and generalized aches and pains. The temperature rose to 101°F. Some hours later itching set in and an erythematous eruption was discovered. The patient was given sedatives, analgesics, and antipruritic lotions, and the Mapharsen was not repeated. After forty-eight hours, all symptoms had subsided. A day later, at 6:30 P. M. Mapharsen, 0.04 gm. was injected intravenously. Within thirty minutes severe itching set in, and an urticarial eruption appeared. This eruption later lost its urticarial characteristics but retained its pruitus and erythema. The patient again complained of headache, generalized aches and pains, and tender, swollen cervical lymph glands. The temperature was 102°F. Epinephrin, salicylates, and codeine did not relieve the symptoms.

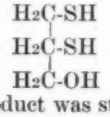
At 8:00 A. M. the next day the temperature was 101°F. The symptoms were little changed. Treatment was instituted with intramuscular injections of 10% BAL in oil, 1.8 c.c. being given every four hours. At 4:00 P. M. that day, after two injections of BAL and at the time of the third injection the temperature was 98°F. and the patient was symptom free. The day's course of four injections of BAL was completed. No more was given. The patient has since had no further trouble.

The case was interpreted as an arsenical reaction due to hypersensitivity, with threatened and impending arsenical dermatitis that well might have gone on to the dread exfoliative dermatitis. The course of events seems to warrant the conclusion that the arsenical reaction was stopped almost immediately by the administration of BAL.

## DISCUSSION

BAL has proved to be one of the outstanding products of medicine developed during the recent war. It resulted from researches by British workers in their efforts to develop an antidote for Lewisite, hence its name BAL, or British Anti-Lewisite.

Lewisite is a war gas developed in this country during World War I. It differs from most other vesicant gases in that it contains arsenic and therefore adds arsenic intoxication to its other ill effects. The British workers, Stocken and Thompson, used as a basis for their studies the knowledge dating back to Paul Ehrlich in 1909 that arsenic is toxic by virtue of the fact that it binds the sulfhydryl (SH) radicals of the body, radicals that are essential to normal respiratory processes of life. Ultimately they developed 2, 3-dimercaptopropanol, a dithiol compound with this formula:



At first this product was studied to determine its effects when applied externally in detoxifying Lewisite. Experimentally it was found that BAL, when applied in an ointment base is useful both in the prevention and in the treatment of Lewisite intoxication.

Immediately it became apparent that BAL might be useful in arsenical poisoning of any kind, so it was administered, at first by inunction, in cases of exfoliative dermatitis in patients receiving arsenical anti-syphilitic therapy. The results were gratifying. Very soon after that investigators discovered that BAL can be administered by intramuscular injection and it is now used in this manner.

Most of the unfavorable reactions to the arsenical therapy of syphilis are promptly and greatly helped by administration of BAL provided that treatment is not "too little, too late." Early adequate treatment is imperative. Arsenical dermatitis, when treated in this manner, responds well and promptly. Toxic encephalitis likewise responds well. Agranulocytosis and "arsenical fever" respond in nearly all cases. Massive overdosing with Mapharsen has been successfully treated. However, arsenical jaundice frequently does not respond well to treatment with BAL. The reason is probably that treatment cannot be instituted early enough, for by the time jaundice has become apparent, liver damage has already become extensive. Aplastic anemia likewise has not cleared up under BAL treatment, again probably because treatment is begun too late.

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BAL also serves as an antidote for other heavy metals, it having been found to be valuable in the treatment of intoxication with mercury and cadmium. Also there is some evidence indicating its usefulness in poisoning by other heavy metals such as bismuth, lead, and gold.

The dosage of BAL recommended is 2.5 to 3.0 mgm. per kg. of body weight. Such an injection may be given every four hours for two days, four times on the third day and twice a day thereafter as long as necessary. Fewer doses may be required for less severe conditions.

The systemic side-effects of BAL appear promptly and are acute. They come on within a few minutes after the injection and usually disappear within thirty minutes. They include a feeling of constriction in the throat and chest, pallor, "shakiness," sweating, nausea and vomiting, burning and tingling of the extremities, lips, tongue and mouth, pain in the head and teeth, increased pulse rate, and elevated blood pressure. Administration of a barbiturate promptly relieves these symptoms.

Abscesses at the sites of injection have occurred in some cases of arsenical exfoliative dermatitis but not in any other cases.

SUMMARY

BAL and its use in the treatment of poisoning with certain heavy metals, especially arsenic, is discussed. A case history is given of a patient in whom it was successfully used.

This new drug is valuable and important and physicians generally should be prepared to administer it in suitable cases.

BAL is now available in ample quantities through the usual commercial drug channels.

# THE EFFECT OF ALTERING THE CALCIUM CONTENT OF IMMATURE RABBITS ON THE SEROLOGICAL RESULTS

EDWARD L. BREAZEALE[1]
and L. F. PIERCE[2]

IN a series of papers by Breazeale[1], Breazeale and Reusser[2], Breazeale, Pierce and Reusser[3], and Pierce and Breazeale[4], the mechanism of the flocculation test has been studied. In these papers the investigators have brought out considerable evidence that the reaction is one of base replacement where the antigen reacts as a zeolite and the reagin as the exchangeable base. From these results it would seem that the so-called reagin is merely an increase in some normal constituent, the change being not an increase in total amount but rather an increase in the availability. Previous work strongly indicates that the bivalent cation of calcium is the element in the serum responsible for the production of the floc.

By definition a zeolite is a hydrated aluminosilicate possessing the power to exchange its base for another base. The zeolites possessing monovalent bases are dispersed in water solution with the exception of hydrogen which functions like a divalent base. Zeolites having divalent cations as bases are flocculated in water suspension. Numerous organic compounds possess this same power of base exchange. Therefore, when we take a serum containing relatively large amounts of calcium in readily available ionic form and add a colloidal indicator possessing base exchange power saturated with sodium, it is evident that the ionic calcium will replace the Sodium on the indicator, thereby converting it to a Calcium complex and producing flocs. This appears to be the mechanism of the reactions we know as the flocculation or precipitation tests for syphilis.

In previous papers it also has been shown[5, 6] that one can alter the ionic concentration of sera, thereby changing sero reactivity. This point was brought out in the latter paper[6] when calcium compounds such as calcium chloride and calcium gluconate were injected into the animal's veins. In the same paper the effect of feeding Vitamin D and injecting parathyroid extract was discussed. It will be noted that in these experiments the total amount of calcium was actually increased, thereby undoubtedly increasing the amount of ionic calcium. In these earlier experiments only adult animals were used (rabbits ten to twelve months old).

Since in a healthy adult animal the calcium demand, especially for bone formation, is not as great as that of a young immature animal, it would appear as though it would be necessary to raise the serum calcium content of a young growing animal much higher in order to obtain

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positive serological results than would be necessary on an adult animal of the same species. In order to ascertain what effect altering the ionic content of the blood of young growing animals would have on the serology of the animals, the following experiments were carried out.

## EXPERIMENTAL

A series of eight healthy rabbits from the same litter were used throughout these experiments. The animals at the time of first examination were eight weeks old. Each week the animals received a different treatment intended to alter their serum calcium content. The treatments consisted of: 1st week, 100 units of Ertron orally; 2nd week, 12 units of parathyroid extract intra-muscularly; 3rd week, 20 mg. of Ca as $CaCl_2$ intravenously; 4th week, 20 mg. of Ca as calcium gluconate intravenously; 5th week, 100 units of Ertron; 6th week, 12 units of parathyroid; 7th week, 20 mg. of Ca as $CaCl_2$; and 8th week, 20 mg. of Ca as calcium gluconate.

Blood samples were drawn 12 hours after injection or feeding and again 72 hours after administration. Serum calcium was determined following the method of Clark and Collip[7], and standard Kline diagnostic, Kahn and Hinton determinations were run on the inactivated sera. The results on the control reaction (8 weeks) and the subsequent 8 weekly specimens taken at the 12-hour interval are given in Table I. In all cases the reactions to the serological tests were negative and the serum calcium was normal at the 72-hour interval.

## DISCUSSION

Kemp, Fitzgerald and Sheperd[8] present a very excellent review of the literature dealing with the occurrence of positive serologic tests for syphilis in animals other than man. This review covers the literature up to 1940 as well as some of their own findings. In the article these investigators bring out the fact that "in two animal species, dogs and cattle, and probably sheep as well, the number of positive tests increased with the increasing age of the animal." The experiments in this paper confirm these investigators' findings. That is, in young imma-

TABLE I
THE EFFECT OF ALTERED CALCIUM LEVEL AND AGE OF THE ANIMAL ON SERO-ACTIVITY

| Rabbits | | 1 | | 2 | | 3 | | 4 | | 5 | | 6 | | 7 | | 8 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Weeks | Treatment | Ca | SERO | Ca | SERO | Ca | SERO | Ca | SERO | Ca | SERO | Ca | SERO | Ca | SERO | Ca | SERO |
| | | mg/100 ml | | mg/100 ml | | ng/100 ml | | mg/100 ml | | mg/100 ml | | mg/100 ml | | mg/100 ml | | mg/100 ml | |
| 8 | None | 9.0 | Neg. | 9.0 | Neg. | 9.5 | Neg. | 8.5 | Neg. | 9.5 | Neg. | 9.0 | Neg. | 9.0 | Neg. | 9.5 | Neg. |
| 9 | Ertron 100 Units | 12.0 | Neg. | 14.0 | Neg. | 14.5 | Neg. | 16.0 | Neg. | 23.0 | 2+ | 19.0 | 2+ | 15.0 | Neg. | 22.0 | 2+ |
| 10 | 12 Units Parathyroid | 14.0 | Neg. | 15.0 | Neg. | 15.0 | Neg. | 18.0 | Neg. | 18.0 | Neg. | 16.0 | Neg. | 16.0 | Neg. | 18.0 | Neg. |
| 11 | 20 mg Ca as $CaCl_2$ | 15.0 | Neg. | 15.5 | Neg. | 16.5 | Neg. | 16.5 | Neg. | 16.5 | Neg. | 16.5 | Neg. | 16.5 | Neg. | 16.0 | Neg. |
| 12 | 20 mg Ca as Ca Gluconate | 15.0 | Neg. | 16.5 | 4+ | 17.0 | 4+ | 16.5 | Neg. | 16.0 | Neg. | 15.0 | Neg. | 15.0 | Neg. | 16.0 | Neg. |
| 13 | Ertron 100 Units | 15.0 | Neg. | 15.0 | Neg. | 16.0 | Neg. | 16.5 | Neg. | 15.0 | Neg. | 15.0 | Neg. | 15.0 | Neg. | 17.5 | 4+ |
| 14 | 12 Units Parathyroid | 18.5 | 2+ | 15.0 | 2+ | 15.0 | Neg. | 15.0 | Neg. | 16.0 | 1+ | 16.0 | 1+ | 16.0 | 1+ | 16.5 | 4+ |
| 15 | 20 mg Ca as $CaCl_2$ | 16.5 | Neg. | 16.0 | 3+ | 16.0 | 3+ | 16.0 | 2+ | 15.5 | 1+ | 16.0 | 2+ | 15.0 | 2+ | 16.5 | 4+ |
| 16 | 20 mg Ca as Gluconate | 16.0 | 3+ | 15.5 | 4+ | 16.5 | 3+ | 15.0 | 4+ | 13.0 | 2+ | 16.5 | 4+ | 16.0 | 4+ | 17.0 | 4+ |

ture animals the incidence of positive serologic findings is very low, and it is very difficult to produce a positive test by altering the divalent cation content of their blood.

Earlier papers form this laboratory[6] discussed the effect of altering the divalent cation content in vivo and in vitro on the reactivity of adult animals and on sera. In these papers the point was brought out showing that if the calcium content of an animal's blood is increased from 9 to 12 mg/100 ml its reactivity to the various precipitation tests will have shifted from negative (9 mg/100 ml) to 2 or 3 plus (12 mg/100 ml). An examination of Table I will show that the rabbits at 9 weeks were negative when they had a calcium level of 16 mg/100 and that when their level was raised to 19-23 mg/100 they gave a 2 plus reaction. As these animals became older the calcium level necessary to produce a positive reaction to the various syphilis tests became lower until at the end of their 16th week 15.5 mg/100 was sufficient to produce a 4 plus reaction. The animals received the same dosage throughout the experiments. Therefore it will be seen that as the animals became older they required less calcium to produce a positive reaction. These figures explain the observations of Kemp and his co-workers[8] in that the young immature animals may have a greatly increased calcium level in their blood yet not react positively to the syphilis tests. A logical explanation seems to be that the young growing animal ties up all available calcium for body growth, thereby immobilizing it and at least removing it from the ionic form. In order for the divalent cation $Ca^{++}$ to produce a floc with the zeolite-like antigen of the test it must be in the free ionic form and not in the bound form.

Kemp and his co-workers[8] make the following statement as final in line with their conclusions:

"We feel as a result of this study that the frequency with which positive tests for syphilis occur in animals other than man is not relevant to the problem as to their validity where they are the only evidence of syphilis in man."

In view of the data presented in the experiments outlined in this and previous papers it would appear that the so-called "reagin" as some investigators are inclined to call the active ingredient in syphilitic sera, and also the active constituent in animal sera, is one and the same; namely, a divalent cation. Therefore, the fact that animals respond to the alteration of the ionic content in the same way as man would indicate that the above statement of Kemp *et al* would be misleading. In our opinion the very fact that animal sera behaves identically the same as human sera is a very relevant point. This "reagin" in animal sera may be absorbed out in the same manner as syphilitic "reagin"[4]. Animal sera may be made negative by irradiation with electromagnetic waves[1]. Horse and cow sera may be made negative by treatment with zeolites possessing monovalent bases[5, 6]. And finally, from the evidence presented in this paper that young animals require a higher level of "reagin" than mature animals, it would further tend to indicate that the action was the same in man as in animals.

Every serologist and physician has had difficulty at one time or another with varying serological results on young children, prenatal specimens, and on patients suffering from diseases other than syphilis. The answer to all of these problems is not immediately forth-coming. All too many persons are too willing to pass it off with the simple remark "laboratory error." However, a more logical answer is that the ionic divalent cation content has varied, thereby varying the reactivity of the sera. *This fact is strongly brought out in young children possessing all the stigma of congenital syphilis, but where repeated tests by various laboratories remain negative.* This might be explained by the fact that the young growing children are utilizing the calcium as rapidly as it is available and leaving only a minimal quantity in the ionic form to react to the test.

## CONCLUSIONS

1. The calcium content of the blood of a series of young growing rabbits was altered by various methods over a period of 8 weeks.

2. As the animals became older the serology became positive without raising the calcium content as high as that of the younger animals.

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# MISCELLANEOUS SECTION

## Arizona Medical Problems

### CONSULTATION AND CASE-ANALYSIS

**ARIZONA MEDICINE again presents an unsolved and difficult case from the practice of Arizona physicians, with the Case-Analysis and comments of a specially-chosen and nationally-known Consultant.**

**Any physician who has an undiagnosed case which has defied other methods of solution may send it for consideration. The case should be completely worked up, but an editor will help compose the report. Whenever the need for an answer is urgent, the Consultant's reply will be sent direct to the submitting physician, before publication.**

**Please send communications and data to Dr. W. H. Oatway, Jr., 123 S. Stone Avenue, Tucson, Arizona, or care of The Editor, Arizona Medicine.**

*(The Consultant* for this case is *Dr. Ovid O. Meyer,* Professor of Medicine and chairman of the department, The University of Wisconsin Medical School; Physician, State of Wisconsin General Hospital; author of numerous reports on clinical and experimental subjects; and well-known to Arizona physicians for his lectures on medicine during visits to this state.)

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CASE NUMBER III

The patient is a white boy of 11 years. He has lived in Arizona for 10 years, has had no unusual illnesses, and there is no history of sore throat. His tonsils have never been removed. The family and social histories are not relevant.

He was well until December 23rd, when he developed a severe sore throat, a fever of 104 degrees, general aches and malaise, and swelling of the anterior cervical areas. He was put to bed, and when the illness persisted, a doctor was called. Gargles, aspirin, and "sulpha pills" were prescribed, but the pharyngitis persisted and the fever continued above 102 degrees for several weeks. A culture was taken. and the condition was called "Strep Throat." The "sulpha" was continued and he remained in bed, but in about three weeks his knees became inflamed, swollen, and very painful to move. They were kept in flexion, and he preferred to remain curled up in bed and immobile.

Within the next few weeks he developed transient swellings on the chest, the face, and most notably on the right forearm, and several joints became sensitive and painful on movement. Malaise, anorexia, sweating, and loss of weight were present. Though there were some variations in his condition, the fever remained elevated to 101 degrees each day and the knees remained inflamed. The pharyngitis subsided.

In early February, about seven weeks after the onset, he was seen in consultation. His chief complaint was, "I ache all over." A week earlier there had been a further increase in the fever, general aching, pain in the knees, and he complained of pain in the chest and abdomen. On the day before he was seen the right forearm became swollen and painful, a swollen area appeared later to the left breast, and there was swelling around the right eye. A second physician had seen him, and prescribed "sedative pills", which were ineffective.

On examination he appeared febrile, in pain, and afraid to move. His knees were slightly swollen, fixed in complete flexion, and immobile in that position because of pain. The calf muscles were flaccid and atrophic. The ankles and hip joints were normal, the movement was guarded because of the knee condition. There was a brawny, tender swelling of the right wrist, chiefly of the ventral surface; it was tense, apparently extended as deep as the tendons, and was a mottled red and purple in color. The hand was swollen and cyanotic, probably from obstructed circulation. The liver was enlarged 6 cm. below the R.C.M., and the spleen was easily palpable several cm. below the L.C.M. The abdomen was very tender. There was a dusky-pink, edematous swelling around the right eye.

It was obvious that nursing care, diagnosis, and therapy would be difficult in the home, and hospitalization was immediately arranged.

He was admitted to the hospital on February 13th. His temperature was of the remittant type, ranging from 100 to 102 degrees; the pulse was 128 to 140; and the respirations 20 to 26/min. The urine was normal except for a trace of albumin (absent 10 days later). The RBC was 3,610,000; Hb. 8.83 gm; WMC. 35,580, with PMN. 79% (64 segm., 15 stab.), lym. 15%, monos 6%. The Kahn was negative; a blood culture was negative; and blood agglutinations were negative in all dilutions for protens 0x19, B. abortus, B. mellitensis, B. tularense.

Two days later the swelling and discolorations of the right hand and arm had enlarged; the brawny swelling below the left axilla had enlarged to a mottled bulge 6x10 cm. in size, which was fluctuant and very tender. A superficial brawny tender mass developed in the abdominal wall in the left umbilical area. The respirations rose to a range of 40 to 60/min. Sulfadiazine was given in full doses by mouth. An incision was made into the "abscess" on the left chest, but no pus was found, a smear was negative for pus or organisms, and a biopsy showed only hyperemia and a few WBC.

Two days later, on February 18th, it was noted that the swelling of the face and eyelids was less, the right arm and legs were the same, the liver and spleen were still enlarged, but the superficial lesions of the left chest and abdominal wall had cleared about 75%. A WBC was 44,300, with PMN. 84%, lym. 9%, and M. 7%. He was given a 500 c.c. transfusion.

Two days later the fever, pulse, and respirations were at the same levels. The skin lesions had all receded somewhat, and even the right arm was less edematous and mottled. The sulfa-

diazine had been well tolerated, but it was decided to shift to penicillin intramuscularly, 10,000 U. every 3h. for 20 doses.

Two days later, two significant findings developed—a papular red rash in the necklace area, and severe dyspnea and cyanosis. Physical signs showed a huge pleural density on the left, with a shift of the mediastinum to the opposite side. Fluoroscopy confirmed these findings, and an aspiration was done. One thousand c.c. of a clear, yellowish green fluid were removed, and it promptly became gelatinous. The fluid stood overnight before culturing, and showed gram positive cocci and bacilli after 48 hours, diphtheroids after 10 days. The specific gravity was 1.019, the total protein was 22.5gm/liter, and the few cells were endothelial, lymphocyte, and neutrophiles.

The aspiration relieved the dyspnea, and four days later physical signs demonstrated that the remainder of the fluid had absorbed. A brawny tender mass developed on the left biceps area, and the conjunctival swelling returned bilaterally so severely that it produced an ectropion of the lids. Both blepharal and bulbar portions were swollen. Since penicillin had had no effect on the vital signs, sweating, or the superficial lesion formation, it was discontinued and sulfamerazine was started.

Four days later, on March 1st, the fever was slightly less, but the malaise was the same, general feeling was poor, and the legs were so tender they could not be moved, with purple striae on the lateral surfaces of the knee-joints. The ectropion was less marked, but fluid was reforming in the left chest, pain and a friction rub were present in the lateral right chest, and the patient was losing weight. The liver and spleen were smaller but tender; the inflamed areas on the arms were tender but less swollen. The temperature range was 99 to 101 degrees, a slight decrease which may have been partly due to the addition of salicylates to the codeine and barbiturates.

Two days later, abruptly, all of the swellings were nearly gone. The fluid in the left chest had reabsorbed; the spleen was no longer palpable; the liver was only 2 cm. below the RCM; the eyelids were no longer everted, but were pseudoptotic.

Because of nostalgia, improvement, and limited finances he was allowed to go home and continue bed-rest. The RBC was 4,380,000, Hb. 9.66 gm, WBC 43,100, PMN .93% (segm. 87, stabs. 6), lym. 4%, M. 3%. He was given another transfusion before discharge.

He has been seen at home several times in the past few months. Sulfamerzine and analgesics were used regularly for several weeks. He lost weight during the illness, but the fever slowly disappeared, and the pain has lessened after smaller flareups in the knees, right shoulder, chest, and occiput. The liver and spleen are normal in size, and the arm and face swellings are gone. For a few weeks the jaws were limited to 50% mobility, but the pain and limitation then cleared. He could not cooperate in orthopedic care because of pain, but he believes that the left leg is straightening out spontaneously since the inflammation has cleared. There are no signs of lung involvement, and the heart is normal except for a soft localized apical systolic murmur which is thought to be hemic. His total time in bed has been five months.

The RBC is 3,840,000, Hb. is 9.2 gm., WBC, 23,400 (PMN 83%, L. 10%, M. 7%).

In view of the previous recurrences and because of the possible prognostic value, we would like the answers to several QUESTIONS—

1. What is the probable diagnosis?
2. Are the bacteriologic findings of any significance? (We have regarded them as contaminants.)
3. What can be done in the way of—
   a. further diagnosis
   b. treatment
   c. prophyllaxis?

M. D., Tucson, Arizona.

ANSWERS—

This is a very interesting, certainly atypical, case which requires careful analysis. Many conditions come to mind which might explain the symptomatology, but after proper study one is forced to conclude that this boy has an unusual form of acute rheumatic fever.

The positive reasons for arriving at this conclusion are as follows: The onset of joint involvement was three weeks after an upper respiratory infection, during which streptococci were found on throat culture. The interval is characteristic, and the illness occurred in a child of eleven. The febrile course, with remissions, exacerbations, and associated characteristic joint involvement, is similar to the usual course; the pain is "fleeting," and as one joint subsides, another is involved. Apprehension often accompanies great joint tenderness. Sweating may occur in any febrile state, but it is especially marked in acute rheumatic fever, and may have a sour odor.

Rheumatic fever is a disease involving mesenchlymal tissues and mesothelial linings, and involvement of the pleura, with pleural effusion, and perhaps even the peritoneum may occur. (The abdominal tenderness might also be explained on the basis of vascular or organic lesions which are common in rheumatic fever.) The liver and spleen were enlarged. Liver involvement is common in rheumatic fever; splenic enlargement is not, but it occasionally does occur, and the question of bacterial endocarditis is then raised.

The leukocyte count is unusually high for acute rheumatic fever, but leukocytosis is the rule, and argues against certain of the other considerations. Hypochromic anemia is almost invariably present, and it exists here. The effusion usually contains much fibrin and clots quickly, conforming to the clotting and high protein content found here.

Any of several rashes may appear in rheumatic fever; erythema marginatum is the most

common, but a papular rash such as described is not unusual. The dyspnea is accounted for by the pleural effusion and anemia, though it is well to bear in mind that dyspnea is usually the first sign of pericardial involvement in acute rheumatic fever. The variable cultures from the pleural fluid were thought to be without significance by the attending physicians, and the reviewer concurs.

Salicylates quite specifically control the fever of acute rheumatic fever; here the fever was only lowered, and one wonders about adequacy of dosage. (EDITOR—The doses were small, and were given for pain.)

There are certain findings that are difficult to place in the picture, particularly the appearance of some of the joints, the development of thoracic and axillary lesions which simulated abscesses, and the edema about the eyes and in the conjunctiva. Nevertheless, vascular lesions which are now well-recognized by pathologists could explain all of these changes, and allow them to be called a part of this unusual case.

The other considerations which one might consider in the *differential diagnosis* are numerous. I shall attempt for brevity's sake to exclude the most likely with one or two objections in each case, acknowledging that complete disposal of each possibility is not necessarily thus achieved.

*Lupus erythematosis disseminata* is a strong consideration, but the occurrence in a male is rare. There is absence of the typical facial lesions, a leukopenia is much more characteristic, and the lack of albumen and red blood cells in the urine is uncommon.

*Periarteritis nodosa* is another serious possibility. Most cases which are diagnosed antemortem have an eosinophilia in the blood which is lacking here; the biopsy was negative; and albuminuria, not a consistent finding here, is almost invariable.

The patient was too acutely ill for chronic meningococcemia; lived too long for acute meningococcemia; and the blood cultures were negative. The long course, the absence of eosinophilia, the prominence of joint changes, and the scanty muscle involvement argue against trichinosis.

Brucellosis, tularemia, and rickettsial disease are excluded by appropriate negative agglutination tests, though 5 per cent of cases of brucellosis may have negative agglutination. Subacute bacterial endocarditis is probably excluded by the lack of evidence for endocardial lesion and the negative blood cultures. Rheumatoid arthritis is excluded by the lack of residual joint involvement and the presence of acute, transient lesions. It might be noted that splenic enlargement is quite common in the rheumatoid arthritis of childhood.

The history, the remittent febrile course, the pleural involvement, and the character of the pleural effusion are against scurvy. Many febrile conditions with central nervous system involvement seem unlikely because of the paucity of central nervous system signs and symptoms. Tuberculosis and mycotic infections seem excluded by the lack of positive evidence in the history and progress of the illness; joint involvement in these conditions is likely to be monarticular, persistent, and sinuses often form.

*In summary*, analysis permits the conclusions that this is an infection and a systemic disease, characterized by fever, "fleeting" joint pains, pleuritis, leukocytosis, and anemia, occurring in a boy of eleven and lasting for five months. *Rheumatic fever* seems the most likely diagnosis.

Only protracted observation may settle the diagnosis. Serial electrocardiograms might, however, be helpful in demonstrating the myocardial involvement which occurs in practically all cases of acute rheumatic fever.

The treatment calls for long rest and large doses of salicylates (5 to 10 grams daily). Intravenous administration of the salicylates has no advantage over the oral method so far as the course of the disease or complications is concerned. The prognosis for recovery in the acute attack is good (98 per cent); the incidence of permanent cardiac damage is considerable and well-known. Prophylaxis is never certain, but a warm dry climate is probably favorable; there is considerable evidence that the administration of sulfanilamide or some other sulfonamide may be helpful, using doses of about 1 to 2 grams daily during the months when recurrences are most likely.

OVID O. MEYER, M. D.,
The State of Wisconsin
General Hospital

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SOUTHWEST MEDICAL ASSOCIATION
WILL MEET IN PHOENIX
NOVEMBER 6 - 7 - 8

## AMERICAN COLLEGE OF PHYSICIANS ANNOUNCES ITS ANNUAL SESSION AT SAN FRANCISCO

### APRIL 19-23, 1948

The American College of Physicians will conduct its 29th Annual Session at San Francisco, April 19-23, 1948. General Headquarters will be at the Civic Auditorium. Dr. William J. Kerr and Ernest H. Falconer, both of San Francisco, are the Co-Chairmen for local arrangements and the program of Clinics and Panel Discussions. The President of the College, Dr. Hugh J. Morgan, Professor of Medicine at Vanderbilt University School of Medicine, Nashville, Tennessee, is in charge of the program of Morning Lectures and afternoon General Sessions.

Secretaries of medical societies are especially asked to note these dates and, in arranging meeting dates of their societies, to avoid conflicts with the College Meeting, for obvious mutual benefits.

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# Voluntary Medical Prepaid Plans As They Apply to Rural Communities

By J. S. JONES
*Executive Secretary*
Minnesota Farm Bureau Federation

Voluntary prepaid medical care is no longer an experiment. We have had enough experience learned by the cut and try method in so many places until we now are approaching the place where we have enough historical background to be of considered actuarial value. The first plans date back to 1882. Prepaid medical care was the subject of experiment and applied to low income groups during the depression and has reached its present status pretty much in the last ten years. Factors that have brought prepaid medical care to the forefront in recent years are:

1. The first real impetus given to the plan was the success obtained by Blue Cross hospital service plans. One of the resistences offered rurally to Blue Cross was "Why not medical care?" With this as a background state medical associations and laymen took notice and began to develop similar plans relative to prepaid medical care.

2. The lack of health facilities and health plans among the low income groups led to the development of a philosophy of governmental care among segments of our population. However, the proponents of that philosophy are now living in the past, due to changed economic conditions. In 1929 the average per capita income for the nation was $686. "Not much there for any kind of medical care." In 1945 the average per capita income was $1150. This improvement in the economic picture is a source of gratification. With the improved economic situation and the increase in the per capita income rural people in particular have turned their thinking to those factors which make for better living and that is better schools and better health facilities.

Group prepayment plans for hospital service and medical care have been organized, stimulated and developed to a great degree by Farm Bureau. Farm organizations in a large manner have set the rural pattern. While these plans are not complete and perfect, they have shown the way to attack the problem of health security.

The additional value of farm organizations is of great significance. We, the people, are a part of such enterprise; we have a part in its building and know the responsibilities, and therefore, know they are superior to the government-purveyed, subsidized attack on the problem. I like to think, in connection with the Blue Cross movement, that we truly have done as much for Blue Cross as Blue Cross has done for people in rural communities. When improved relationships develop and are in existence among present health facilities, hospitals, physicians and lay organizations, all existing health facilities can be more fully utilized and by working together recognize the need, the time and the place for necessary additional facilities which may be bet-

NOTE TO EDITOR: A summary of a talk given in Chicago Friday morning, February 7, at the Second Annual National Conferesce on Rural Health, sponsored by the Committee on Rural Medical Service of the American Medical Association.

ter observed and as well as more economically offered and administered.

While the early prepaid plans were successful, including practically all medical service plans, experience has indicated that rural people generally were not ready to pay the premiums for such broad contracts, with the result that development of prepaid rural health care plans progressed slowly—we have felt it preferable to begin operation with limited coverages and expand the services offered as experience indicates and necessity develops.

The expansion of prepaid medical care is limited largely by the ability and the willingness of the public to enroll. We must first know what subscribers can afford to pay and what must be the charges if the plan is to remain financially sound.

Most plans have tended to concentrate on enrolling large groups to obtain an adequate risk-spread and a sound financial position. Based on experience they can then expand their benefits and extend enrollment practices. We have found, in connection with our work in Blue Cross, that we pursued the principal course in developing prepaid hospital care plans first to the point where there was a recognition of the service and an appreciation of the value of the ability to pay and the possibilities of the plan.

Secondly, following with medical care with proper limitations, looking to the forward, aggressive development of the voluntary acceptance of the prepayment idea of the hospital plan, medical, surgical plan, or a combination of both, with possible additions and limitations on each.

The problem is one for the various communities. It must be worked out in the community where the need exists. Everyone in the community must help if the effort is to succeed. Prepayment plans for medical care, available for all people in the community, towns people and farmers alike, spread the risk and distribute the cost. Then when the costs are known in advance, proper planning and budgeting for the otherwise predictable cost is possible. Hospital management is responsible for the hospital aspects of the program. Physicians are responsible for the professional aspects of the program. The public cannot escape the responsibility of paying the costs of the service, and of cooperating with and becoming a part of the agencies providing the same and by so doing their full share in providing the needed facilities, with full cooperation between the members of the profession and the people of the community the program can succeed, and I feel that it is highly important that the sponsors should develop the program a step at a time, and those steps undertaken only when participants in the program are fully informed.

Then progress can be made as rapidly as experience indicates and as the economic situation permits. Prepaid care is not a pertinent issue of our rural people alone, but it is pertinent to everyone who lives in rural areas. Farmers have friends, relatives, and do business with those who live in cities and villages. Likewise, the city or village people are related to and contact farm people. This is one of the finest examples of mutual understanding on a common problem affecting everybody that can possibly be developed. Rural people are neighbor-minded.

3. Development of the Blue Cross has given impetus to the need of prepaid medical care plans. Those who are participating in prepaid hospital care plans now know that they are capable of taking care of the problem themselves by putting their health bill on an annual budget basis and spreading the cost over a wide area, on an actuarial basis and with the increased income per capita that was mentioned earlier they are capable of taking care of their health needs in a better manner than heretofore.

Permit me to again refer by comparison in health problems to the development of local mutual insurance companies. Many years ago when a fire occurred on a farm it was a catastrophe. The farmer was put out of business on account of the loss of his buildings. The result was the development of the local mutual insurance companies where they paid a certain amount each year and averaged the losses over a wider area, so that when a fire catastrophe would come they were protected and those buildings could be restored without working any great hardship. He has demonstrated that he was capable of paying the bill on this plan. Likewise with the hospital and medical care plan. Major long-time illnesses of some sort will occur possibly every few years, but on the old plan when it did come it was a knock-out blow. Farmers have now learned that by putting their medical and hospital care on an annual budget basis and spreading it out and averaging it over a wide area they are capable of meeting those costs and protecting themselves

so that when that day of accumulated sickness comes, they are current as to payment.

True it was that many of these people could not get medical care, they were afraid, lax, always put off going to the doctor, got along with drug store pills and tablets. On the other hand, many run to the hospital with every little ailment. That's one of the problems in prepaid medical care.

Experience in other countries having compulsory health care shows that time lost from sickness nearly doubled, certainly has not reduced loss of time from illness as is the purpose of any plan to improve health—is it not possible that an informed membership in a voluntary plan has its advantages over a compulsory plan?

There are those who preached the philosophy that rural people cannot do this, that their incomes are not sufficient. This is the group that wants to see governmental medical care in force. Of all the groups of people that I know that do not want government in business it is the farm people. Illness and its care is a personal problem. If I know anything about human philosophy and human instinct, the ability to pay as a factor that has hindered proper medical care would have to take second place now.

In my judgment, fear on the part of rural people has been a greater retarding factor in the development of health programs and medical care than any other item. The problem of fear is and will never be overcome by compulsory methods of plans. Self-service and self participation in the program will go farther, it will not be spectacular, it will not be done over night, but it will be done by this method on a safe, sound and constructive basis.

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## Report of Delegate

House of Delegates,
American Medical Association,
June 9-13, 1947, Atlantic City, N. J.

The meeting of the House of Delegates during the Centennial Meeting at Atlantic City this year consumed four days of business sessions. This was due to the vast amount of business which was introduced for consideration and, in addition, the workings of the House was interrupted at frequent intervals for the introduction of numerous foreign physician guests. Many of these had prepared letters of congratulations to the members of the A.M.A. during this celebration, or spoke extemporaneously with greetings from their respective foreign Medical Association or Government. There were over one hundred guests representing many of the Medical Societies throughout the world.

The total registration of physicians at the meeting was 15,667, with over 2,200 Auxiliary members registered for the twenty-fifth Anniversary of the founding of the Woman's Organization.

The Scientific programs presented at this meeting by members of the A.M.A. and by the foreign physicians guests demonstrated beyond question the many advancements being made by medical men all over the world. The Scientific program, and the exhibits, however, are only a part of any A.M.A. Convention. It is in the House of Delegates where one realizes that medicine today in America constitutes a vast enterprize. Its structure is large and varied, and one has difficulty in comprehending its scope. The economics of medicine, its public relations, its legislative phases, and its relations to various government agencies all occupy the attention of the House of Delegates.

In addition, this year, a meting of State Presidents and other State Officers was held on June 8, where a formal program was observed on some of the state and national problems. At this meeting, Senator Taft addressed the conference on National Health Legislation now pending in Congress. General Hawley spoke on the Veterans Care Plans, particularly as they apply to private practitioners. Our state secretary, Dr. Milloy and myself attended this meeting.

For the first time, also, a National Conference of County Medical Society Officers was held on June 8. The program in this instance was concerned with medical organization problems, the techniques, means and methods of improving state and county medical societies, as well as further steps to be taken to make the A.M.A. a working partner of every physician.

It is in the House of Delegates, however, where

the basic policies of American medicine are set. The House hears the reports of the Councils and Bureaus, as well as the Officers of the Association. It is to this body that all the resolutions are introduced for action, whether they have to do with economics, law, legislative or particular phases of medical organization. Some forty odd resolutions were introduced at this session.

A resume of some of the actions taken at this meeting should be of interest to all physicians

Some of the more important subjects and actions taken are as follows:

1. The Committee on National Emergesey Medical Service was discharged and in its place a Council on National Emergency Medical Service was created to work as a body under the Board of Trustees. The work of this group will consist in planning for medical care of civilians and military personnel alike in the event of another national emergency.

2. The Board of Trustees was instructed to select a different meeting place for the House of Delegates semi-annual session, so that there will be a different geographic district each year. Along with this, there will be a two-day session of scientific nature for general practitioners at the time of the semi-annual meeting, either two days before or two days afterward. The first of these meetings will be held next December at a time and place designated by the Board of Trustees. It is hoped that this scheme will "raise the general practitioner to the eminence he deserves."

3. The Secretary of War and the Army and Navy Surgeons General addressed the House on the present state of military medicine. All sounded the need for more military medical officers. The house endorsed legislation now in Congress which if passed, will raise both the military doctor's professional status, as well as his pay.

4. The House established a new Committee to work with other interested groups on the present critical Nursing Problems.

5. In another resolution, the War and Navy Departments were asked to revamp their organizations, in case of another war emergency, so that there would be no medical over-staffing, that doctors would not be used for non-medical duties, and that too many doctors be not taken out of civilian practice.

6. A resolution was rejected which would cause the Army and Navy to take over the medical care of servicemen's dependents, now conducted by the EMIC.

7. The House approved an extension program of teaching medical economics in medical schools. The A.M.A. was directed to prepare material, evaluate programs, and prepare men for the purpose of teaching this subject.

8. Action was taken to tie in a closer affiliation with third and fourth year medical students, possibly by admitting them as affiliate members, and the re-establishment of a student section in the Journal. The possibility of a student section of the scientific assembly was studied.

9. The House agreed to establish a scientific section on Diseases of the Chest, to take effect after the constitution and by-laws are changed and adopted at the next regular session.

10. An A.M.A. study of group practice was approved by the House. It did not approve, however, of setting up a bureau on group practice at headquarters.

11. In order to help settle some of the issues involved with the various Specialty Boards, the House authorized the Board of Trustees to create a special committee to study medical schooling in relation to the public needs, to determine how small hospitals could be used to train G. P.'s to check on the present supply of doctors, and to more generally define a general practitioner. At this convention, the American Academy of General Practice was formed. It will help encourage young doctors to remain family physicians, will set up courses in post graduate training, and help protect the G. P.'s right to engage in medical and surgical practices for which he is qualified.

12. The A.M.A. Secretary, in collaboration with the councils and bureaus was instructed to prepare an illustrated booklet describing the various activities carried on by the Association for distribution to graduating medical school classes.

13. Actions were taken also for the purpose of clarifying the public relations activities of the A.M.A., of better methods of transmitting information to the House of the activities of the departments, bureaus and councils; methods of utilizing the Woman's Auxiliary to better advantage in the field of public relations, and the House within the near future will have to think of expanding the building program for the Association headquarters.

It would be impossible, of course, to cover the

full text of each report, of the Officers, the various councils and bureaus in this resume, as well as the various resolutions and reference committees' recommendations. Each member can and should read the full report of this meeting as published in the Journal. One can realize, in so doing, that the House of Delegates has a vast amount of business thrown into its agenda. With an honesty of purpose, and with serious thought and discussion, the members of the House of Delegates tackle the problems presented, so that the best in Medicine can be brought to the American people in a manner exemplified by our democratic way of life.

The new officers of the Association, elected at Atlantic City, for 1947-48 are:

Dr. Roscoe L. Sensenich, South Bend, Indiana, President-Elect.

Dr. Thomas A. McGoldrick, Brooklyn, N. Y., Vice-President.

Dr. George F. Lull, Chicago, re-elected Secretary and General Manager.

Dr. Josiah J. Moore, Chicago, re-elected Treasurer.

Dr. R. W. Fouts, Omaha, Nebraska, re-elected Speaker of the House.

Dr. Francis F. Borzell, Philadelphia, Vice-Speaker of the House.

Dr. Dwight H. Murray, Napa, Cal., re-elected to a five-year term, Board of Trustees

Dr. Edward J. McCormick, Toledo, Ohio, elected to serve a five-year term, Board of Trustees.

Also:

Dr. Lloyd Noland, Fairfield, Ala., re-elected as a member of the Judicial Council.

Dr. John H. Musser, New Orleans, re-elected as a member of the Council on Medical Education & Hospitals.

Dr. William Middleton, Madison, Wis., elected member of the Council on Medical Education and Hospitals.

Drs. Stanley P. Reimann, Philadelphia and L. B. Jackson, San Antonio, elected to the Council on Scientific Assembly.

Dr. James R. McVay, Kansas City, Mo., re-elected a member of the Council on Medical service, and

Drs. Elmer Hess, Erie, Pa. and Jesse D. Hamer, Phoenix, Ariz., elected to the same council.

The House of Delegates selected Chicago as the 1948 convention city; Atlantic City for the session in 1949 and San Francisco in 1950.

Respectfully submitted,
J. D. HAMER, M. D.

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# Poliomyelitis Current Literature

## A PERIODICAL ANNOTATED LIST

Prepared by the Library of
THE NATIONAL FOUNDATION FOR INFANTILE PARALYSIS
mostly from material supplied by the Editors of
*"A Bibliography of Infantile Paralysis, 1789-1944"*
at the American Medical Association, Chicago.

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Buchanan, Josephine; Hirt, Susan, and Wrisley, Florence—(Med. Coll. Va.)

A POLIOMYELITIS PROGRAM IN A GENERAL HOSPITAL. Arch. Phys. Med. 28:289-294 (May, 1947).

"Between July, 1945 and November, 1945, 191 patients were admitted to the Medical College of Virginia hospitals with a diagnosis of acute anterior poliomyelitis. This represented a sudden large influx of patients in need of specialized care. The Baruch Center of Physical Medicine and the Medical College of Virginia Hospitals provided this care in such full measure that the average time spent in the hospital was only forty-five days for the white patients and seventy-nine days for the Negro patients, and 90 per cent were discharged with no or minimal disabilities, amenable to outpatient checkups and home treatment programs. Both the setting up and the carrying out of a program for the care of so large a group of poliomyelitis patients in a general hospital presented many problems. The major needs for this program were found to be: 1. Adequate bed space to be utilized as long as necessary for optimal treatment. 2. Adequate specialized nursing care. 3. Adequate subprofessional help for applying hot packs and for transporting patients from bedside to treatment center. 4. Adequate number of physical therapists especially trained in poliomyelitis care. 5. A closely cooperating team of physician-specialists in pediatrics, orthopedics and physiatrics. 6. A brace and corset shop, staffed by specialists, located within the hospital. 7. Adequate follow-up care and continued treatment as out-patients."
(Authors' summary)

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Collins, Vincent J.; Foster, William L., and West, William J. (Army and Navy General Hospital, Hot Springs, Arkansas).

VASOMOTOR DISTURBANCES IN POLIOMYELITIS, WITH SPECIAL REFERENCE

TO TREATMENT WITH PARAVERTEBRAL SYMPATHETIC BLOCK. New England J. Med. 236:694-697 (May 8, 1947).

"Vasomotor disturbances, such as edema, hyperhidrosis, coldness and chilblanns, are frequently necountered in the convalescent period of poliomyelitis. Sympathetic nerve blocks were employed to alleviate these distressing manifestations of disturbed vasomotor activity with partial to complete relief in 15 cases. Pain, muscle spasm and muscle tenderness were completely relieved in 3 cases by sympathetic nerve blocks and without supplementary therapeutic measures, such as physiotherapy and hot packs. It is suggested that the pain, tenderness and muscle spasm in the acute phase of poliomyelitis may also be alleviated by sympathetic blocks. (Authors' summary.)

7 references.

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Fisher, Ernst—(Medical College of Virginia).

MUSCLE STRENGTH AND THE WEATHER. Arch. Phys. Med. 28:295-300 (May, 1947).

The effect of weather upon morbidity and mortality was considered important in ancient times but has been neglected in modern etiologic concepts. However, in the past twenty-five years, work has been done on this subject. Areas of high and low pressure moving across the country and bringing sharp sudden changes in temperature are apparently the weather components most effective upon body functions.

A series of experiments in which grip was measured by a Smedly hand dynamometer were performed. The data collected are not sufficient to permit any final statement about the effect of weather changes and muscle strengts, although they are rather indicative that the weather represents a factor of significant importance, at least from a theoretical point of view. It seems at least possible that the results of muscle testing as performed clinically in convalescent poliomyelitis patients are appreciably affected by the waather prevailing on the test day.

12 references.

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Lawson, Robert B., and Melnick, Joseph L.—(Yale Univ. Sch. Med).

INACTIVATION OF MURINE POLIOMYELITIS VIRUSES BY HEAT. J. Infect. Dis. 80:201-208 (March-April, 1947).

"Milk exerts a protective action on the destruction by heat of rodent adapted and spontaneous mouse poliomyelitis viruses when infected central nervous system tissue is heated in this medium. Milk enables these strains to withstand about 5 to 10 C more heat for 30 minutes than when the infected tissues are suspended in water. No such protection is noted when infectious mouse intestinal contents are used as a source of virus.

"The concentration of virus plays a role in its thermal liability. The more dilute the virus suspension, the less heat is required to inactivate it, even though all dilutions are made in milk.

"When concentrated suspensions of infected nervous tissue are heated for 30 minutes, occasional traces of virus may be detected when the temperature is kept at 65 C and 70 C. This is above the temperature commonly used in pasteurization (61.7 C). However, the number of variables which affect this type of experiment are great so that unqualified didactic statements about the thermostability of these agents cannot readily be made.

"No information about human (monkey adapted) poliomyelitis virus is furnished by these experiments.

"It is our belief that the knowledge of the survival of poliomyelitis virus in milk and ice cream is inadequate." (Authors' summary.)

15 references.

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Pray, L. G.—(Fargo Clinic, Fargo, North Dakota).

OBSERVATIONS ON A POLIOMYELITIS OUTBREAK IN NORTH DAKOTA IN 1946 (WITH SPECIAL CONSIDERATION OF SPINAL FLUID FINDINGS). Journal-Lancet 67:202-205 (May, 1947).

"The cases of 80 children with poliomyelitis have been analyzed. Our results and reports in the literature indicate that alterations in spinal fluid findings are not essential to the diagnosis of poliomyelitis; of primary importance are the history and physical examination of the patient. In one half of abortive cases and in 15 per cent of paralytic cases, the spinal fluid cell counts were normal during the early stage of the disease. No fatalities occurred in these 80 children. Epidemiological and virus studies reported in the literature show that the virus of poliomyelitis is harbored in the throat as well as the intestinal tract; spread of the disease is characteristic of air-borne infections, with the likelihood that sewage and insect vectors may also play a part. It appears wise to keep children away from crowds during epidemics, as susceptibility is greatest during childhood, although present to a lesser extent in adults as well. Advance preparations by interested groups made adequate care of patients possible during this epidemic." (Author's summary)

20 references.

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# *Editorials*

## Two Current Grievances of the Public

Some five or six years ago when the first bill for compulsory health insurance was introduced in Congress, the leaders of American Medicine suddenly sat back and took inventory of the situation. In brief, the results were readily discernible.

1. Scientifically as a medical organization we had made tremendous strides. We had added ten or fifteen years to life expectancy since the turn of the century.

2. Individually, the American physician is a highly respected member of his community. He has a certain number of patients and friends who sware by him through thick and thin.

3. But as a group, and a national organization our standing was practically nil. We had completely overlooked the subject of public relations.

Today Public Relations is one of the livest topics of discussion in meetings at the national level, at the state level and at the county level. And every organization is searching for public relation officers. We find ourselves engaged in a great campaign. A campaign to convince the American Public that with our system of private practice of medicine, with the aid of physician-controlled Blue Cross hospital organizations, and voluntary prepaid medical plans, we will deliver a much better brand of medicine to them than can be concocted by any legislative rabbit pulled out of the sleeve of some politician or social worker in Washington.

The most important function of a Public Relations program is to correct grievances. Hence the occasion for this editorial. A prominent member of the Arizona Legislature recently complained to a member of our Association that it was practically impossible to get a doctor at night. Therefore, the State laws regulating the admission of osteopaths and chiropractors should be liberalized so the people could get more medical care. As always, there are two sides to every question. Why is it impossible to get a doctor at night? We hear it said also that you cannot get a plumber, or a carpenter, or a bricklayer to do anything these days. And the answer is that the plumber and the carpenter and the bricklayer are not hungry. The doctor is very human also and he is not hungry either. So a sudden drop in our economic level and this grievance would end over night. There are other angles to this subject, however. A large segment of our people have their own private or family physician and no conscientious doctor will refuse to get up at night to take care of his own patients. But not many doctors relish the thought, especially when he is working ten or twelve hours a day, of getting up at 3 o'clock in the morning to call on a perfect stranger, or even some other doctor's regular patient. A little different situation exists in Arizona than in most places. While many of our permanent inhabitants have their own physicians, we have thousands and thousands of travelers and visitors who are absolute strangers in our community, and we owe these people much consideration. A common remark about night calls is that about three out of four are unnecessary and could wait until morning. We must revert to psychology to answer this remark. As soon as darkness settles, the human becomes scared. So that fear is probably the diagnosis in three out of four night calls. But right there while one out of four cases really need medical care, any osteopath with a little psychology can quiet the fears of these other three cases just as well as a full fledged physician. So our good Senator has a 3 to 1 argument in favor of letting the bars down to the cults. But aside from such comments this seems to be a problem to be solved at the county and city levels. It is always the duty of our younger doctors to make night calls. We have physician's directories in our cities, and a little cooperation between our county societies

and physician's directories, along with some education of the public by newspaper and radio advertising, should do much to eliminate this common complaint.

The second grievance is the refusal of a physician to make a call on a patient who is dying with the remark that "Well, if he is dying, there is nothing I can do." Every doctor knows his place in a death room. And here again the explanation is fear. The human is scared of death, which is quite natural, and the first one they think of to assume the responsibility is the doctor.

We may sum up the whole subject by saying that the practice of medicine has reached such a point where a doctor's every action reflects not upon himself alone, but on the entire medical profession.

Your State Officers know that when the bill is introduced in the legislature to let the bars down to the cults, that a flood of protests will flow into the Central office. But they also know that the loudest protests will come from the very members who refuse to make night calls, or are guilty of various other actions which reflect upon the society as a whole. It can be added at this point that your state society has had a very active legislative committee for some time. They cannot go around broadcasting it, but they always have their ears to the ground, and especially when the legislature is in session. And as proof they can point to the record. Constructive legislation which the Association has sponsored has always passed and very little adverse legislation is ever enacted into law. And here again is a point where our medical association from the national level down has made a dismal failure. Public health laws, and laws to raise the standards of medical practice are for the protection of the public, and not legislation to line the pockets of the Medical Trust, which is the constant accusation of our critics.

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# IN MEMORY OF OUR HEROES

Two young Arizona physicians and surgeons, each with a promising career ahead of him, gave up their lives in honor of their country during the recent war. Each was a native-born Arizonan, each being from a distinguished Arizona family.

MANNING GUNTER, son of Dr. and Mrs. Clarence Gunter of Globe, was born at Tucson, Arizona, May 18, 1911. He had eight years of grammar school and four years of high school at Globe, graduating from high school in 1930. He spent two years at the University of Arizona then transferred to the University of Alabama where he graduated with the degree of Bachelor of Science in 1934. He then entered the College of Physicians and Surgeons, Columbia University, graduating in the class of 1938. He had two years' internship at New York City Hospital and a six months' service in a post graduate hospital in New York City in special surgery. He practiced in Globe with his father, Dr. Clarence Gunter, until the war and then joined the Army Medical Corps as a First Lieutenant in February, 1942. He trained in California with the Seventh Division and went with them to Attu, landing on Attu with the first 200 soldiers. He then went to Kiska. After a short time there he went to Hawaii with the Seventh Division to recuperate. They then went to Kwjalien and there he received a Bronze Star and was made a Captain in the Medical Corps. He then went through the Leyte campaign, then to Mendora, and then to Okinawa. At Okinawa he was awarded the Silver Star for gallantry in action and was killed there on May 5, 1945. Dr. Gunter was not married and is survived by a brother, a sister and his father, Dr. Clarence Gunter. His mother is not living.

ARTHUR WILLIAM WILKINSON, son of Mr. and Mrs. Francis Marion Wilkinson of Phoenix, was born on November 23, 1911 at Phoenix. His grammar school education was obtained from Pendergast Grammar School and St. Mary's Grammar school, both of Phoenix. He graduated from Phoenix Union High School in 1929 with valedictorian honors. He was awarded the Harvard Scholarship by the Harvard Club of Arizona. He attended Harvard University, receiving various scholarships in science for outstanding work, and graduated with high distinction in 1933. He taught school in Chicago during 1933-34. In 1934 he entered Harvard Medical School and graduated in 1938. He interned at St. Luke's Hospital, Chicago, following which he served a Surgical Residency at the same institution. In 1940 he became Resident Surgeon at the Good Samaritan Hospital, Phoenix, serving until 1941 when he entered the service and was commissioned Lt. jg) U. S.

Navy Reserve. Dr. Wilkinson entered active service and was reported missing in action when the U. S. S. Sims was lost in the Battle of the Coral Sea on May 7, 1942.

On October 18, 1941, Dr. Winkinson was married to Miss Patricia Hilvert, daughter of Mr. and Mrs. Fred G. Hilvert, a prominent Phoenix family. He is survived by his wife, Patricia, his parents, Mr. and Mrs. F. M. Wilkinson, sisters, Bertha, Catherine, Nellie and Virginia, and brothers, F. M., Jr., Henry, and Robert.

Both these young physicians were an honor to themselves, their families and their country. We salute their lives and their memories!

## *Book Reviews*

**POSTGRADUATE OBSTETRICS: By William F. Mengert, M. D. Professor and Chairman, Department of Obstetrics and Gynecology, Southwestern Medical College. Chairman Obstetrics and Gynecology, Parkland Hospital, Dallas, Texas. Paul B. Hoeber, Inc. Medical Book Department of Harper and Brothers. New York. London. Price $5.00.**

Material in Postgraduate Obstetrics was chosen according to statistical frequency of complications in the realm of the family physician.

Beginning with the various pregnancy tests, Dr. Mengert follows through with discussions on every phase of pregnancy, labor, and puerperium. Of especial interest are chapters on diseases related and unrelated to pregnancy, abnormal pregnancy, anamolies of the expulsive forces, care of the new born, diseases of the new born, and the emotional stresses of pregnancy.

Save for the discussions on carcinoma of the cervix and inversion of the uterus, rare complications have been omitted.

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**ANNUAL REPRINT of the Reports of the Council on Pharmacy and Chemistry of the American Medical Association for 194. Cloth. Price, postpaid $1.00. pp. 135. Chicago: American Medical Association, 1947.**

This volume was formerly of most interest to those who wished to know why the Council on Pharmacy and Chemistry had not accepted certain of the preparations it had considered. The reports were mainly those of rejection; though, through the years, the educational nature of the Council's work was attested by status reports on drugs, or therapeutic procedures, or preliminary reports on agents showing promise of usefulness but not yet ready for adoption by the general and medical profession. In recent years, the tendency has been toward a preponderance of the educational type of report. In the present volume, both the condemnatory and the educational phases of the Council's work are represented.

There are three reports of vigorous condemnation: first, the report on Cabasil, a curiously unscientific mixture whose exploitation for use in a multitude of diseases is aptly summarized by the sub-title of the report, "Quackery Unlimited;" second, the report on the pseudo-scientific Ethylene Disulphonate (Allergosil brand), a preparation of highly uncertain nature exploited to physicians for use in allergic conditions; third, Formula A-N-1, a joint report of the Council on Pharmacy and Chemistry and the Council on Industrial Health, concerning an expensive but poor substitute for aspirin and citrate of magnesia, cleverly promoted to industrial concerns for use in reducing absenteeism due to colds.

Among the status reports, the excellent article of Dr. Samuel M. Feinberg, "Histamine and Antihistaminic Agents," is probably most worthy of mention. Since its appearance, the Council has accepted for inclusion in New and Nonofficial Remedies, the two new agents of this class evaluated in the article, Diphenhydramine Hydrochloride, and Tripelennamine Hydro-

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chloride (Benadryl Hydrochloride and Pyribenzamine Hydrochloride, respectively).

Pharmaceutical and scientific investigators, alike, will be interested in the informative report on the Council's new Therapeutic Trails Committee. Of special interest to manufacturers is a statement on the revised rules of the Council, though this exposition of the trends of Council policy is of concern to all who are interested in progressive rational therapeutics.

Attention is called to the several reports on the adoption of generic designations for drugs proposed or marketed under protected names. Not all such actions of the Council have been the subject of separate published reports; the recognized terms have appeared in the published descriptions of the drugs when accepted, and will be inserted in another Council publication, New and Non-official Remedies, as adoption of such designations for already accepted protected names proceeds.

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NEW AND NON-OFFICIAL REMEDIES. 1947,* containing descriptions of the articles which stand accepted by the Council on Pharmacy and Chemistry of the American Medical Association on Jan. 1, 1947. Cloth. Price, postpaid, $3.00. pp. 749. Philadelphia: J. B. Lippincott Co., 1947.

Although the latest edition of New and Non-official Remedies has some eleven pages fewer than the 1946 book, its increase in size, due to the heavier paper used, and its change of color—dark green to bright red—combine to make a striking contrast with the earlier annual volumes. The book is now published by J. B. Lippincott and Company, though it is still issued under the direction and supervision of the Council on Pharmacy and Chemistry. Another innovation is the relegation of the statements of tests and standards to the back of the book, which makes the text more convenient and useable for the physician, for whom it is primarily intended. It is understood that supplements to the annual volumes will no longer be issued. The physician who is interested in current acceptances can keep track of these as the descriptions are published in the Journal A.M.A., or may inquire about them by addressing the Council's office at A.M.A. headquarters. Several medical and pharmaceutical journals now carry lists of currently accepted products.

There appears to be no very extensive revision in the various general articles or chapter head discussions, although several new monographs have made their appearance and others have


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been revised to reflect current medical opinion. One notes the appearance of a new chapter, "Unclassified Therapeutic Agents," which includes the monographs on Gold Compounds and Iodine Compounds for systemic use. This is in line with the policy adopted some years ago of classifying accepted preparations according to phormacologic action and therapeutic use.

Attention is called to the amplification and indexing of the section devoted to the statement of the Council's Rules. This should be of great assistance to manufacturers in the presentation of products for Council consideration and is no doubt inspired by the recent marked increase in the number of pharmaceutical concerns asking Council recognition.

The descriptions of some thirteen new preparations appear in this volume. This excludes, of course, brands or dosages of already accepted agents. Among those preparations noteworthy of mention are the pertussis vaccines and vaccines representing combinations of pertussis with diphtheria and tetanus organisms; the new histamine-antagonizing agent, Benadryl Hydrochloride Elixir (Diphenhydramine Hydrochloride Elixir); Furacin (Nitrofurazone) a new topical anti-infective agent; Streptomycin; Heparin Sodium; Parenamine, a new casein hydrolysate; Thiouracil, an antithyroid agent; Naphuride Sodium (Suramin Sodium) a new trypanocide; and Tuamine (Racemic 2-aminoheptane), a new vasoconstrictor. One notes the increasing appearance of generic designations in conformance with the revised Council's rules on acceptance of agents bearing protected or trademarked names.

New and Non-official Remedies remains a most valuable and authoritative compendium of modern rational therapeutics. With successive editions, it becomes more useful and accessible to the physician and to all those interested in the use, preparation, or manufacture of drugs.

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# ABSTRACTS

JOURNAL OF BONE AND JOINT SURGERY
Vol. 28, No. 3
Old Series Vol. 44, Page 415, July, 1946

## THE TECHNIQUE OF THE SYME AMPUTATION

Lt. Col. Rufus H. Alldredge and
Lt. Col. T. Campbell Thompson
*Medical Corps, A. U. S.*

The authors present 75 cases of Syme amputations which were done as a result of injuries received in World War II. The results were satisfactory in all patients, and complications, which were of a minor nature, resulted in only 10% of the cases.

The Syme amputation has advantages over amputation through the foot or below the knee both from the functional and psychological standpoints and is advocated for young male patients. The patient feels as if he is only inconvenienced instead of handicapped. The prosthesis is not only more comfortable and not so clumsy, but is also simpler and does not require many adjustments. Disadvantages are few, the main one being the necessity for greater surgical skill and the necessity for more care in selection of pa-

Prepared by the Staff of Carrie Tingley Hospital for Crippled Children, Hot Springs, New Mexico.

tients. Circulation and sensation must be adequate.

The requirements essential for a good functioning stump were listed as follows:

1. It should have adequate circulation and sensation.
2. It should be painless and non-tender.
3. It should be capable of full end-weight-bearing with or without a prosthesis.
4. It should be suitable for fitting in a conventional way with a prosthesis which requires no apparatus above the knee.
5. It should show no tendar scars or other areas likely to break down from the use of a prosthesis.
6. It should be satisfactory to both patient and surgeon.

The pre-operative, operative and post-operative care are of equal importance. Pre-operatively the skin should be surgically and bacteriologically cleaner than for any other amputation and the patient's mental condition should be satisfactory. It is suggested that penicillin be administered routinely.

The operative technique is described, particular attention being paid to hemostasis. The surgical procedure is described in three stages:

Step 1. Skin incision, dislocation of the ankle and removal of the calcaneus.

Step 2. Sawing off the malleoli, cutting the tendons and nerves about the ankles, debriding the heel flap and ligating the major vessels.

Step 3. Clamping and ligation of small vessels until a dry field is obtained, closure of the stump, draining and dressing.

Post-operatively the dressings are changed in 24 hours and about 48 hours thereafter. The drain is left in place for one to seven days, depending on the amount of drainage present. A walking pylon is applied between the third and fourth weeks. This type of amputation is recommended for the young male with a good physical and mental outlook.

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## Surgery, Gynecology and Obstetrics, 83:243-248

August, 1946

### SURGICAL ASPECTS OF TRENCH FOOT

ROBERT R. BATES, M. D.
(Major M. C.) *Joliet, Ill.*

Of a series of 4,892 soldiers with frost bite and trench foot, the author had occasion to study 264 of them who had varying degrees of persistent gangrene. Since no preconceived plan of surgical treatment was available at the time, the author, on the basis of his extended experience with this condition, evolved the following plan of treatment which proved to be most satisfactory.

1. Preopera ively, every chance was given for improvement under conservative treatment, namely physiotherapy with special emphasis on active and passive motion and finally preoperative penicillin intramuscularly.

2. A delaying attitude resulted in many spontaneous curves and saved them from needless amputations.

3. Skin graf:s gave way to plantar flaps even if it meant further resections of metatarsal bone. He found no detrimental effects on the gait from resection of metatarsal heads where this was done in order to get sufficient plantar skin to cover the bones.

4. Primary closure, despite the bacterial contamination of all these cases, gave the best results where the head of the 1st metatarsal had to be sacrificed, the sesamoids were also removed.

5. Skin traction was used post-operatively in order to facilitate primary closure of the flaps. In a few instances full thickness grafts were necessary and were done by either cross leg flaps or jumped tubes.

6. All operations were done under pentothal oxygen anaesthesia; incisions being made just proximal to the typically narrow zone of reaction on the plantar skin. No buried sutures were placed. The periosteum was left intact and no unnecessary insult to tissues was permitted in the name of technical expediency.

7. Postoperatively penicillin for several days or until the skin sutures had been removed. At least 30 uneventful convalescent days were required before weight bearing was permitted. A simple prosthesis, based on an insole and lambs wool protected felt block to fill in the space be-

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tween the foot stump and shoe tip, was then utilized to great advantage.

8. **Results**: There were only 23 instances of postoperative infection and 9 instances of dermatitis under this regime of treatment.

J. KULOWSKI, M. D.

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## 83:105-112

### COLLECTIVE REVIEW

### The Treatment of Ununited Fractures of the Neck of the Femur.

RUDOLPH S. REICH, M. D.
*Cleveland, Ohio*

This is an excellent review of the standard methods of treatment of ununited fractures of the neck of the femur along with the author's personal prefernces and interpretations of indications and techniques. His extended experience with this complex problem makes this authoratative, especially in regard to femoral osteotomies. Greater attention has come to ununited fractures in this situation coincident to the added interest in the treatment of fresh fractures of the femoral neck in recent years.

The author divides the various procedures advocated for the relief of non-unions of the femoral neck into two catagories: (1) those designated to restore anatomical and physiological relationships of the hip joint, and (2) reconstruction (palliative) procedures. The former stem from Albee's dowell pin graft method and the latter from the basic osteotomies of Whitman and Lorenz. Anatomical restoration is preferable but the requirements to be met for its successful accomplishment are so varied and exacting that indications for this operation are finely drawn and therefore limited in application.

On the other hand the reconstruction operations. because of their greater simplicity, have become more popular and have a wider field of application. Colonna has described this type of procedure to include, (1) cases in which the femoral head is viable, and (2) those in which there is aseptic necrosis or arthritis of the head. Where a pathological condition exists the removal of the head must be considered. The operations of Whitman and Colonna are admirably suited to these conditions and are widely used. An alternative operation is the arthrodesis of Gill.

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Where the head is viable one of the various types of osteotomy yields excellent results. The original (low) Lorenz and Shanz osteotomies have been modified by the higher ones of Hass, McMurray and finally by Leadbetter's recent cervical-axial technique. The greatest drawbacks to the original osteotomies was the sacrifice of length and tendency to valgus of the knee. These have been largely overcome now by the newer technique. Osteotomies attempt to eliminate the lateral shearing stress by placing the distal fragment inferior to the head, after operation. Oftentimes union of the old fracture site occurs concurrently (or as often as 2 years later) with union of the osteotomized fragments.

Because of improvements in procedure, the criteria for good end results now implies complete correction of the shearing force of the neck on the ununited head, with union of fragments, less shortening, a remarkably increased range of motion, very little pain or discomfort, and a surprising restoration of function. The chief objections to these operations has been the difficulty of accuracy in placing the line of osteotomy because it is essentially a blind procedure. Reich has suggested Steinman pin fixation and x-ray check before the cast has been applied. Leadbetter's procedure is a great advance over former operations because it is visually done and the distal fragment can be more easily implanted under the head and neck, the latter being thrust into valgus position. The older Brackett operation was designed for a similar reason. Blount has advocated the use of a blade-plate as a means of internal fixation following femoral osteotomies, for the purpose of eliminating the necessity for post-operative plaster fixation. In any event there must be enough femoral neck and head in the socket to give adequate purchase of the neck on the remaining head. In these cases one of the reconstruction operations had better be done.

The author states the causes of failure following femoral osteotomy to be (1) improper selection oof the level of the osteotomy (slipping of the fragments), (2) loss of joint motion (3) dense scarring preventing separation or the fragments (Leadbetter's procedure. He does not feel, as does Blount, that the cast is detrimental, nor does he believe that his blade-plate internal fixation is necessary. As a matter of fact, it is the author's opinion that the added surgical insult

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that the pin insertion entails cannot easily be overlooked. He prefers to do the high oblique osteotomy or Leadbetter's operation without this aid, since the blade-plate would, in addition, prevent the final subsequent settling in or jamming inward which is favored by and during the process of absorption of the osteotomy surfaces preliminary to osteogenesis. He definitely prefers the east and states as his only contraindication to it to be in the case of an individual with an arthritic knee, with impending ankylosis, or in whom such ankylosis may result from prolonged immobilization.

The disadvantages of the low osteotomy are stated to be (1) greater sacrifice of length and (2) greater incidence of knock knee deformity.

J. KULOWSKI, M. D.

# NEWS NOTES

## Office of the Surgeon General

### ARMY ENGINEERS TO BUILD GREATEST MEDICAL CENTER

What is planned to be the greatest medical research center in the world will be built at Forest Glen, Maryland, by the Corps of Engineers for the Office of The Surgeon General, according to a recent announcement made by Major General Raymond W. Bliss, The Surgeon General. In keeping with technological advances in all fields, based on experiences in the late war, the center will be equipped to anticipate and meet the medical problems of the future as well as to cope with those of the present. The initial cost is estimated at approximately $40,000,000. Construction will be supervised by the District Engineer, Washington, D. C. Engineer District.

Officially designated as the "Army Medical Research and Graduate Teaching Center," the project will consist of a 1,000-bed general hospital, capable of expansion to 1,500 beds; the Army Institute of Pathology building; the Army Medical Museum and Center Administration building; Central Laboratory Group buildings; and the Army Institute of Medicine and Surgery. A working library, animal farm, quarters for

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the staff and other buildings are included in the plans.

Located just outside of Washington, the new Army Medical Center will have the advantage of close relationship to the Walter Reed General Hospital, the Naval Medical Center, the medical schools of the District and the proposed new Washington Medical Center, with all of whom ideas can be interchanged. In addition, members of the District of Columbia Medical Society, among them some of the finest specialists in the world, and medical experts from other Government departments, will be available for consultation. The Center will also cooperate with the National Bureau of Standards, the National Institute of Health and the National Research Council.

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## SECRETARY OF WAR PATTERSON TELLS OF ARMY'S MEDICAL PERSONNEL

Secretary of War Robert P. Patterson, speaking before the American Medical Association in Atlantic City, New Jersey, on June 10, expressed his "appreciation of the contribution to victory made by the American doctor in World War II, and praised the medical service of the American Army in that war as "the finest of any army in the world,—any place, any time."

He stated, "it was the caliber of the medical care during the war that made the Army resolve to maintain the best features of that service in the years ahead. And so the War Department is taking steps to provide for its modern Army a Medical Corps that can do this very thing."

He stated further "a basic essential to such a Medical Corps is personnel—enough and of the highest possible qualifications. As a step towards making Army medicine a satisfying career for qualified doctors, a bill has been introduced in Congress providing the means to make the Army more tolerable from an economic point of view, and—more important—to make service in the Medical Corps a stimulating experience from a professional point of view."

Speaking before the House of Delegates, Secretary Patterson said, "Present plans of the War Department call for an Army of 1,070,000 men. We shall need an Army of more or less that size so long as we have our present commit-

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ments for occupation abroad and national security at home.

"6,000 doctors are required to provide adequate medical service for an army of 1,070,000 strength. At present we have 5,000 doctors in the Medical Corps. However, only 1,100 of these are in the Regular Army. If the present state of national emergency were to be terminated we would lose all our doctors except those in the Regular Army. Even if the emergency remains in effect, the younger officers now on temporary service will be leaving in large numbers on expiration of their two years' service. Unless prompt measures are taken, the prospects are that we will be short 3,700 doctors by mid-year of 1949, and short 4,000 doctors, or more than two-thirds of our requirement, by mid-year of 1950."

The Secretary said a major step in the program to provide a professionally competent and adequate medical service for the Army is the introduction in Congress of legislation to "provide for the procurement of physicians and surgeons in the Medical Department of the Army." That legislation is identified in the House of Representatives as H. R. 3174, and in the Senate as S. 1143.

"At a casual reading of the bill," he continued "it would seem that the principal purpose of that legislation is to provide more pay for medical officers. Such a conclusion would confuse the means with the end. The actual purpose of that bill is to promote and enhance the professional standing of the Army Medical Corps.

"The War Department is convinced, after more than 170 years of close association with the medical profession, that the skill of the American medical man cannot be bought for dollars and cents. But it is given generously as a matter of patriotism and professional pride. The doctor can have such a pride in the Army medical service only when that service has the highest possible professional dignity. I am already on record with the statement made last year that 'it is my sincere desire to maintain the medical standards of the Army at the highest possible professional level.' I want now to reiterate that statement as expressing both the Army's and my determination. General Eisenhower also expressed the Army's position when, in a memorandum to the Army's top commanders, he said:

'The realization of our objectives places upon us, the military, the challange to make our professional officers the equal in knowledge and training of civilians in similar fields and make our professional environment as inviting as those outside.'

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can be obtained and continued only by establishing a professional level equal to the best in civilian practice. Establishment of that professional level is our goal. All other advanes, benefits or gains serve only as steps toward that goal."

In concluding he said, "The basic need of an adequate Army medical service is a professional competence second to none. The legislation now ward making that high grade professional attainment possible. The War Department will do everything else in its power to establish and foster the professional environment required. I ask your support of this legislation and of our entire Medical Corps program."

---

## Resume of "RECENT ADVANCES IN THE TREATMENT OF LUNG ABSCESSES"

By Dr. Brian B. Blades, Walter Reed General Hospital

Refinemen s in operative technics improved anesthesia and the benefits of antibiotic protected surgery have made it possible to supply safely pulmonary resection for the treatment of chronic, pulmonary abscesses. The approximate mortality rates in the surgical treatment of pulmonary abscess in 1942 was 15.2%. At the present time operative mortality for excisional surgery in the treatment of chronic pulmonary abscess is about 5%; moreover, the number of satisfactory cures has increased from approximately 57% in 1942 to more than 80% at the present time.

During the past war the incidence of acute pulmonary abscesses in members of the Armed Forces was low. It is not surprising that pulmonary abscesses secondary to wounds of the chest were uncommon since it has been established for many years that the lung has tremendous resistence to infections introduced by foreign bodies. It is of interest, however, that so few cases of acute, fulminating pulmonary abscesses were found in the millions of people who were in the Armed Forces. Some idea of the rarity of acute pulmonary abscesses requiring drainage can be obtained when one realizes that during the entire war only three lung abscesses were drained at Walter Reed General Hospital. The

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experiences of others in large Army general hospitals were similar.

The rarity of acute, fulminating pulmonary abscesses and the replacement of thit lesion by more chronic, idolent type of pulmonary suppuration may be explained by two factors. Individuals on military duty have good dental care. Dental caries, abscessed teeth and so forth, do not exist, or if they do are promptly remedied. Therefore, one of the chief etiologic factors for the production of pulmonary abscesses was eliminated. The almost universal use of the sulfonamide derivatives and later penicillin in all types of pulmonary disease probably accounts for the absence of fulminating infections and explains the existence of a more chronic, less severe type of abscess formation.

Since patients were not extremely ill, there was a tendency to delay surgical intervention and, in fact, probably in many cases the infection responded to antibiotic therapy and surgical intervention was avoided. In cases in which tissue destruction was sufficient to require operative treatment the lesions were apt to be multiple involving an entire lobe and in some cases the entire lung. Extirpation of the diseased tissue in these cases gave excellent results. Except in very early cases where the abscesses were well circumscribed and drainage was instituted early, final results were unsatisfactory because of the presence of multiple abscesses and destruction of pulmonary parenchyma.

Data accumulated during the war and subsequent experience in civilian hospitals indicates that in the great majority of cases excisional surgery is the treatment of choice for pulmonary abscesses of all varieties. The necessity for emergency drainage of a pulmonary abscess in its very early stage has been largely obviated by the use of penicillin and other antibiotics.

---

## Resume of "STREPTOMYCIN IN THE TREATMENT OF TUBERCULOSIS"

By Lt. Col. John B. Wallace, MC, Fitzsimons General Hospital

Streptomycin has a beneficial effect, at least temporarily, in a majority of the cases of tuberculosis in which it is used but the treatment is accompanied by some real dangers.

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Such is the indication from observations now underway at the Army's Fitzsimons General Hospital at Denver, a center for tuberculosis treatment.

In the spring of 1936 the Army, Navy and Veterans' administration were allotted an amount of the still rare and costly drug sufficient to permit an investigation of its efficacy, particularly in respect to the disease for which extravagant claims had been made. Fitzsimons hospital was selected as the army installation for this project, carried out under the Division of Research and Development of the Offiie of The Surgeon General.

It is still too early to make definite pronouncements.

Some of the more overt and alarming symptoms of tuberculosis subsided. No doubt remains that streptomycin should be used without delay in cases of tuberculous meningitis, which usually are rapidly fatal. It also may be used with discretion and probably good results in cases of pulmonary tuberculosis.

It is by no means a "cure," however, and there is some evidence that use of the drug slows down the development of the body's natural resistance to the tuberculosis germ. It may temporarily mask symptoms which will appear in more aggravated form later.

Streptomycin also has proved a life saver in several mixed infections of the ear, brain and meninges, or linings of the brain and spinal cord. It is proving quite effective in mastoid infections, usually in conjunction with penicillin but where organisms are present which are resistant to this drug. Some of the most drastic results have been obtained in cases of meningitis, when it is introduced directly into the cerebrospinal fluid. Meningitis may be due to one or more of several organisms, in addition to the so-called meningococci, which are the most common cause. Streptomycin has saved several lives in the army practice.

Some of the best results have come from use of the drug to prevent the spread of peritonitis, provided a susceptible organism is responsible for the condition. There were 52 recoveries among 57 patients, and the deaths of three of those who succumbed was not due directly to


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sistant to any of the sulfa drugs or penicillin, are responsible for some of the most devastating human and animal maladies. These include influenza, poliomyelitis, parrot fever, and a host of others.

The first of the new diseases is encephalomyocarditis. The responsible virus was isolated from the peritonitis. Best results were obtained when streptomycin and penicillin treatments were combined.

In wound infections the new drug cannot take the place of penicillin, although it may be of considerable value in certain selected cases.

Ordinarily the drug should not be used without first determining the causative organism and the dosage to which it is susceptible.

---

Resume of "RESEARCH IN VIRUS DISEASES"

By Dr. Joseph E. Smadel, Army Medical Department Research and Graduate School.

Discovery by Army Medical Corps officers of two hitherto unknown virus diseases of men was announced.

Virus diseases, caused by the most minute known organisms which are relatively highly re- a dead chimpanzee at an Army Air Forces hospital at Coral Gables, Fla., during the war. At that time no human cases were suspected.

The doctors found that this virus caused a rapidly fatal disease with a characteristic pattern in mice, hamsters, cotton rats and monkeys and a non-fatal fever in guinea pigs and rabbits. In the fatal cases it attached the heart muscles, as does ordinary myocarditis, and at the same time caused serious lesions in the brain. The brain attack was chiefly on the cortex of the cerebellum, the organ of "balance."

The organism was shown to have no relationship to about 20 unknown human and animal viruses with which it was matched. A person who once has been infected with a virus disease developes antibodies in the blood which give some degree of protection against re-infection. No such antibodies were found in the blood of hospital patients. There was grave doubt whether encephalomyorcarditis actually was a disease of man.

The antibodies were found, however, in frozen blood samples from patients in a Manila Army Hospital in 1945. There had been no satisfactory diagnosis of these cases. It was recalled, however, that among troops in the Pacific there had been outbreaks of so-called three-day fever. It was, as the name signifies, a fever of rather

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brief duration. No causative agent had been found.

It now appears that at least some of these men suffered from encephalomyorcarditis without, however, the heart and brain involvements found in those animals to whom the malady is fatal. The disease in the soldiers may have existed only as a complication to some other malady.

The evidence to date indicates that while the disease effects man, it is now very serious. Research will be continued, however, because disease-causing viruses are likely to undergo slight mutations which make them devastating.

The other new virus malady—which also does not appear serious at present—is Fort Bragg fever.

Its characteristic symptoms are a brief fever and a rash found chiefly on the front of the legs. The virus has been isolated and is being studied. It appears to be an extremely delicate virus which rapidly is inactivated when kept in extreme cold. This does not effect most viruses.

Finding of some chemical substance which will be effective against viruses—especially the virus of influenza—is one of the major goals of present medical research. Some progress has been made in this direction, Dr. Smadel reported. One drug which seems to inhibit temporarily the growth of flu virus is closely related to atabrine, the malaria-suppressive used on such a wide scale during the war. This particular drug would appear to have no practical value at present. During the past month Rockefeller Institute workers have reported that certain biological substances, such as apple pectin and certain blood substances, have an inhibitory effect on the flu virus.

(Continued on page 78)

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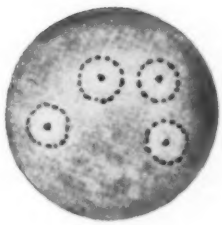

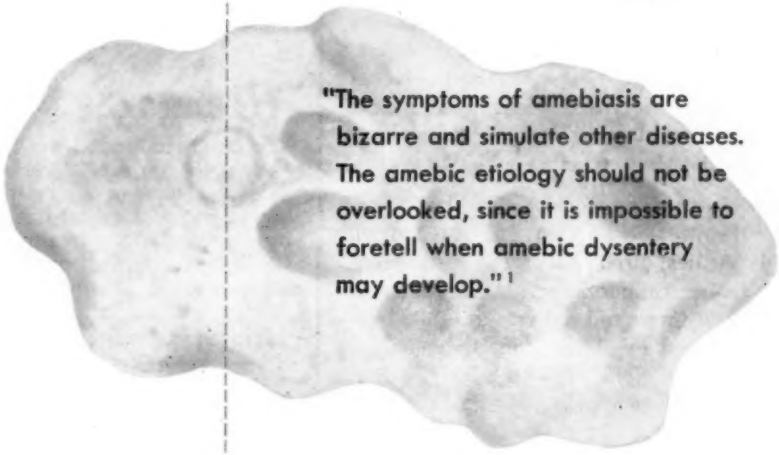

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1. D'Antoni, J. S.: Amebiasis, Recent Concepts of Its Prevalence, Symptomatology, Diagnosis and Treatment, Internat. Clinics 1:100 (March) 1942.

2. Manson-Bahr, P.: Some Tropical Diseases in General Practice, Glasgow, M. J. 27:123 (May) 1946.

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Resume of "RECENT DEVELOPMENTS IN MALARIA THERAPY"

By Dr. Alf S. Alving, University of Chicago

American scientists tested approximately 15,000 chemical compounds during the war in their search for malaria cures or suppressives, but only the 13,276th (pentaquine) offered promise of a "cure" for the tertian malaria which caused loss of 16,000,000 manpower days to the army and navy, together with 363 deaths.

Several drugs were developed which "suppressed" the disease which was one of the greatest single medical problems of the war. Even though a soldier became infected, the characteristic chills and fevers did not appear while such a drug was taken regularly, and the man continued to work or fight. The malaria, however, was almost certain to appear as soon as the drug was stopped.

(Continued on page 80)

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Hundreds of compounds related to plasmochin were tested with experimental animals, both for toxicity and effectiveness against malaria. Finally one known as pentaquine was found to be only about half as toxic as plasmochin and to have considerably greater curative value.

Before the new drug was used with soldiers or sailors it was tested extensively on a volunteer basis with convicts in state prisons, and conscientous objectors, each individual of which volunteered to receive infections with the malaria.

The tests to date indicate, he reported, that the new drug in appropriate doses will reduce the relapse rate in severely infected patients from 98 per cent to 16 per cent. In moderate in-

(Continued on page 82)

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fections the relapse rate can be cut to four per cent. Pentaquine works best, he said, when combined with quinine.

It is not, however, a safe drug for self medication and requires hospitalization, since several complications are possible. In very heavy infections several treatments may be necessary.

Two valuable suppressive drugs were developed, in addition to atabrine, which was used extensively and with fair success early in the war. These are the American chloroquine and the British paludrine. Both were superior in certain aspects to atabrine and each possesses certain advantages which must be wieghed against the particular circumstances.

---

## NUMBER OF BIRTHS REMAINS HIGH DURING FIRST QUARTER OF 1947

In the first quarter of 1947 approximately 973,000 births were registered in the United States, according to preliminary estimates released today by the National Office of Vital Statistics, U. S. Public Health Service, Federal Security Agency. This is 46.5% more than the 664,000 births estimated to have been registered in the first three months of 1946, and it is 29% more than the number recorded in the first quarter of 1943, the year which held the record for births until outstripped by 1946.

Deaths in this country are estimated to have totaled 388,000 in the first three months of 1947. This is the same estimated number as that for the first quarter of 1946. In 1946 there was a mild epidemic of influenza and other respiratory infections that incraesed the number of deaths in January over the number recorded in non-epidemic years. In 1947 the incidence of influenza increased in March and the provisional death rate reported for March was higher than for that month in any year since 1943. The death rate for this past March was 11.3 per thousand population, as compared with 11.7 for March, 1943. For the first quarter of 1947 the death rate on a cumulative basis was 11.0 or 1% less than the comparable rate of 11.1 deaths per 1,000 population (excluding the armed forces overseas) for the first quarter of 1946.

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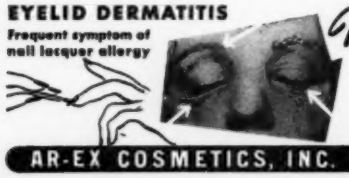

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# RESOLUTION

Adopted by The Board of Directors of The American Society of Anesthesiologists, Inc., June 11, 1947 at Atlantic City, New Jersey—

WHEREAS, the development and furtherance of modern Anesthesiology is of great importance to the welfare of patients, and

WHEREAS, Anesthesiology is a component part of the practice of medicine;

NOW THEREFORE BE IT RESOLVED:

That the American Society of Anesthesiologists, Inc., recommends strongly

A. The establishment of departments of Anesthesiology in all medical schools and hospitals under the direction of a doctor of medicine actively engaged in the practice of Anesthesiology.

B. That the department of Anesthesiology shall bear the same relationship to the medical school and/or hospital as is borne by other medical departments of the institution.

AND BE IT FURTHER RESOLVED:

That The American Society of Anesthesiologists, Inc., disapproves

A. Of the training of persons other than doctors of medicine in the science and art of anesthesia, for the assumption of responsibility in the care of patients where it may be necessary to exercise medical judgment, and particularly does it disapprove of the issuance of certificates for such training by its members.

B. The existance of departments of Anesthesiology in hospitals and/or medical schools under the direction of persons other than doctors of medicine or under the nominal direction of doctors of medicine not actively engaged in the practice of Anesthesiology.

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*In discovering this offending substance (known as an allergen), your doctor acts as a detective. He may ask detailed questions about the time of your attacks, where they occur, the furnishings of your home, the food you eat.*

Such questions may give him clues to the nature of your trouble. If your attacks come, for instance, in the late spring, or summer months and last till the first frosts, he will suspect that your trouble is due to some pollen, that you may have some form of "hay fever."

*In other forms of allergy, it is not so easy to track down the offending substance. If your case is not clear-cut, your doctor must consider hundreds of possibilities.*

A few grains of mustard can make some people violently ill. A man can be sensitive to his wife's face powder, or to dog hair, or grass pollen, or to the cattle hair in the mat under a rug.

*Simple skin tests are often used to reveal the offending substance. Drops of various extracts—of pollen, foods, and other substances—are injected into the skin or put on skin scratches. If you are sensitive to the substance being tested, a swelling will usually develop within a few minutes.*

Once a doctor has found what causes the allergic reaction—by means of the history of the case supplemented by skin tests—he will prescribe treatment according to the nature of the patient's sensitivities.

*If the patient is allergic to a particular food, the easiest solution is to avoid the food. If his sensitivity is to feathers, the substitution of a fibre pillow for a feather one may bring surprisingly effective relief.*

If the allergen is house dust or pollen, or something else that cannot be easily avoided, a series of inoculations may be suggested.

Some people, however, do not respond to this type of treatment, or are sensitive to too many different things to make inoculations a practical procedure. New chemical drugs—developed to control allergic reactions in certain types of allergy—are showing promise. They are to be used, of course, only under the direction of a physician.

SEE YOUR DOCTOR. If you suffer from recurring and unexplained attacks of sneezing, skin rashes, or asthma, see your doctor. In allergy, as in other medical problems, your physician can give you more help today than ever before.

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## *Southwest Medical Assn.*

### GRADUATE SEMINAR TO BE HELD IN PHOENIX

The Graduate Seminar of the Southwestern Medical Association will be held this year in Phoenix November 6, 7, and 8 at the Westward Ho Hotel.

A special effort is being made to obtain a record attendance from Arizona, New Mexico, western Texas, and northern Mexico. It is believed that the program will attract physicians also from California, Nevada and Utah.

All the speakers invited are men with long experience in graduate teaching, are known to be excellent speakers, and occupy positions of prominence in their respective fields.

The following speakers will participate:

Dr. H. L. Bockus—Professor of Gastroenterology, University of Pennsylvania Graduate School and President of the American Gastroenterological Association.

Dr. L. K. Ferguson—Associate Professor of Surgery, Graduate School of Medicine, University of Pennsylvania.

Dr. Max Strumia—Associate Professor of Pathology, University of Pennsylvania Graduate School of Medicine, and an authority in clinical pathology.

Dr. Edmund Spaeth—Professor of Ophthalmology, University of Pennsylvania Graduate School of Medicine.

Dr. B. P. Alpers—Professor of Neurology, Jefferson Medical College.

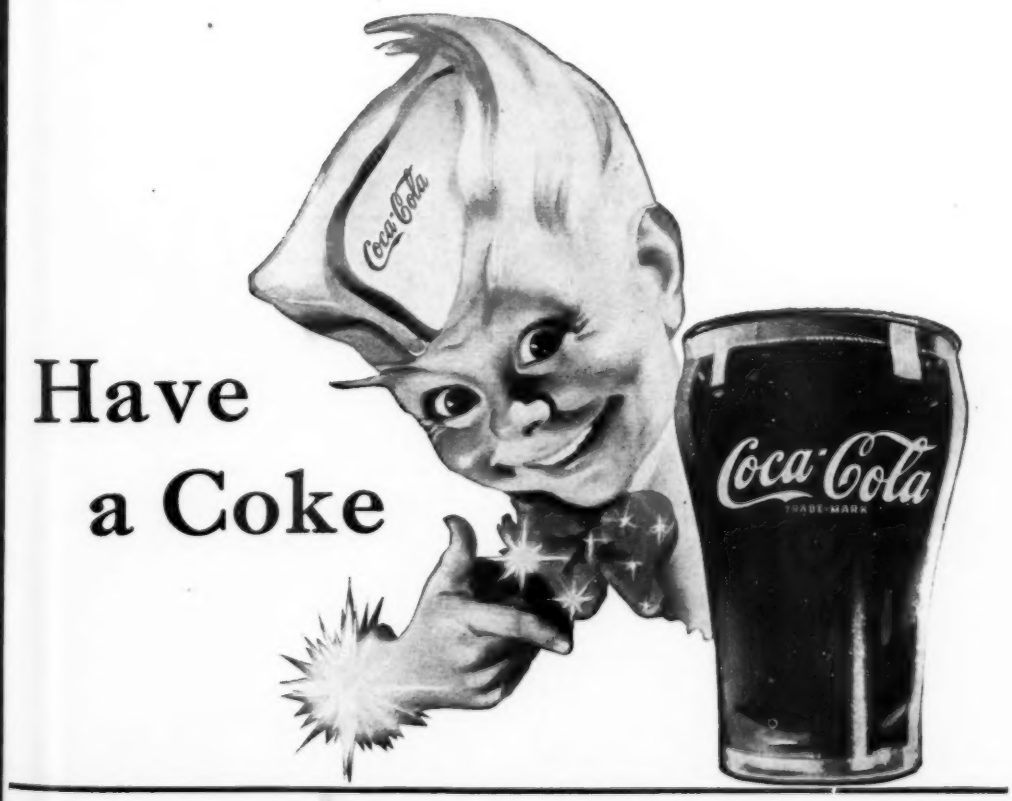
Dr. Ignacio Chavez—Professor of Medicine, University of Mexico and head of the Cardiologic Institute.

This program represents a post-graduate seminar by national authorities brought to the doorstep of the physicians of the state.

There is a nominal registration fee of six dollars.

Hotel reservations should be made early with Dr. James Moore, Professional Building, Phoenix.

JOSEPH BANK, M. D.



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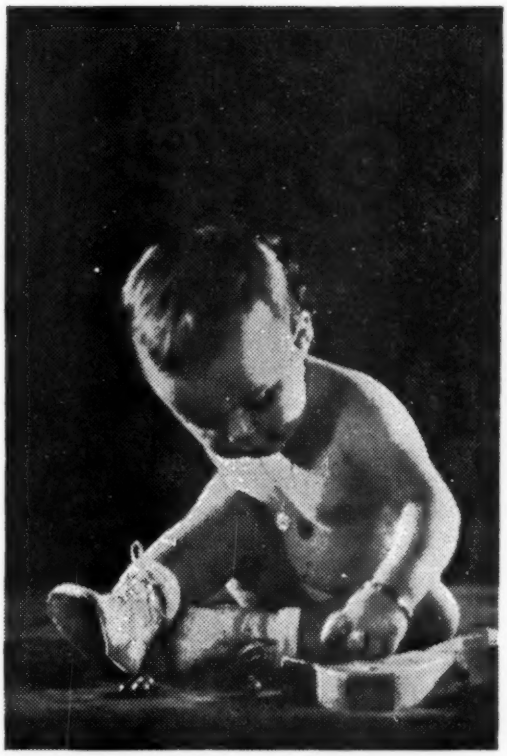

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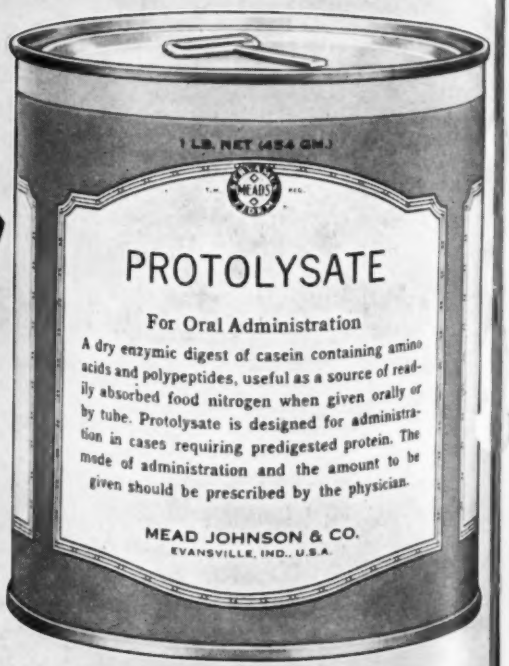
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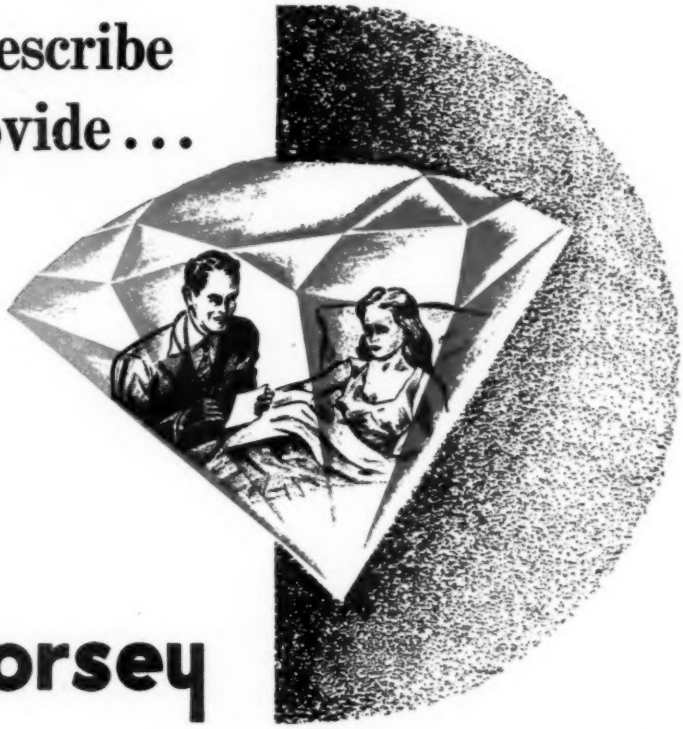

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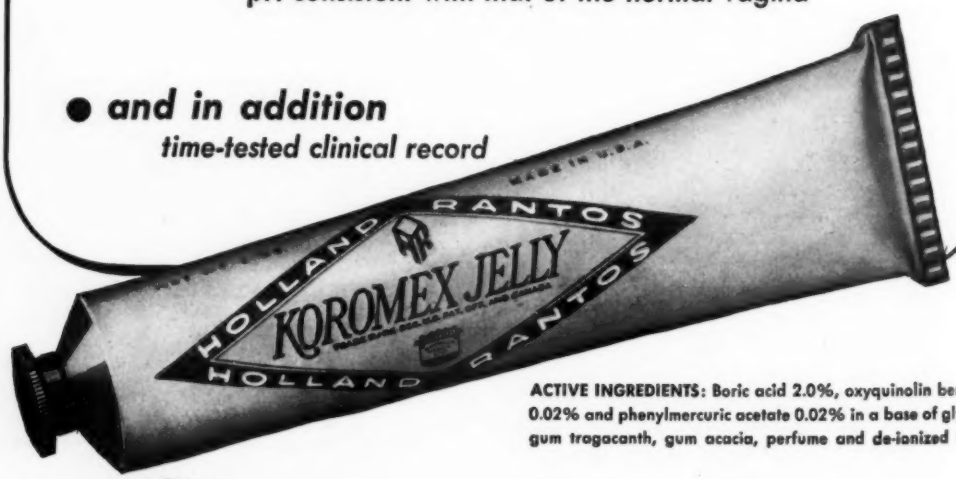


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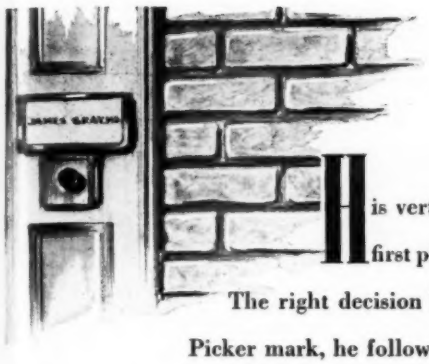

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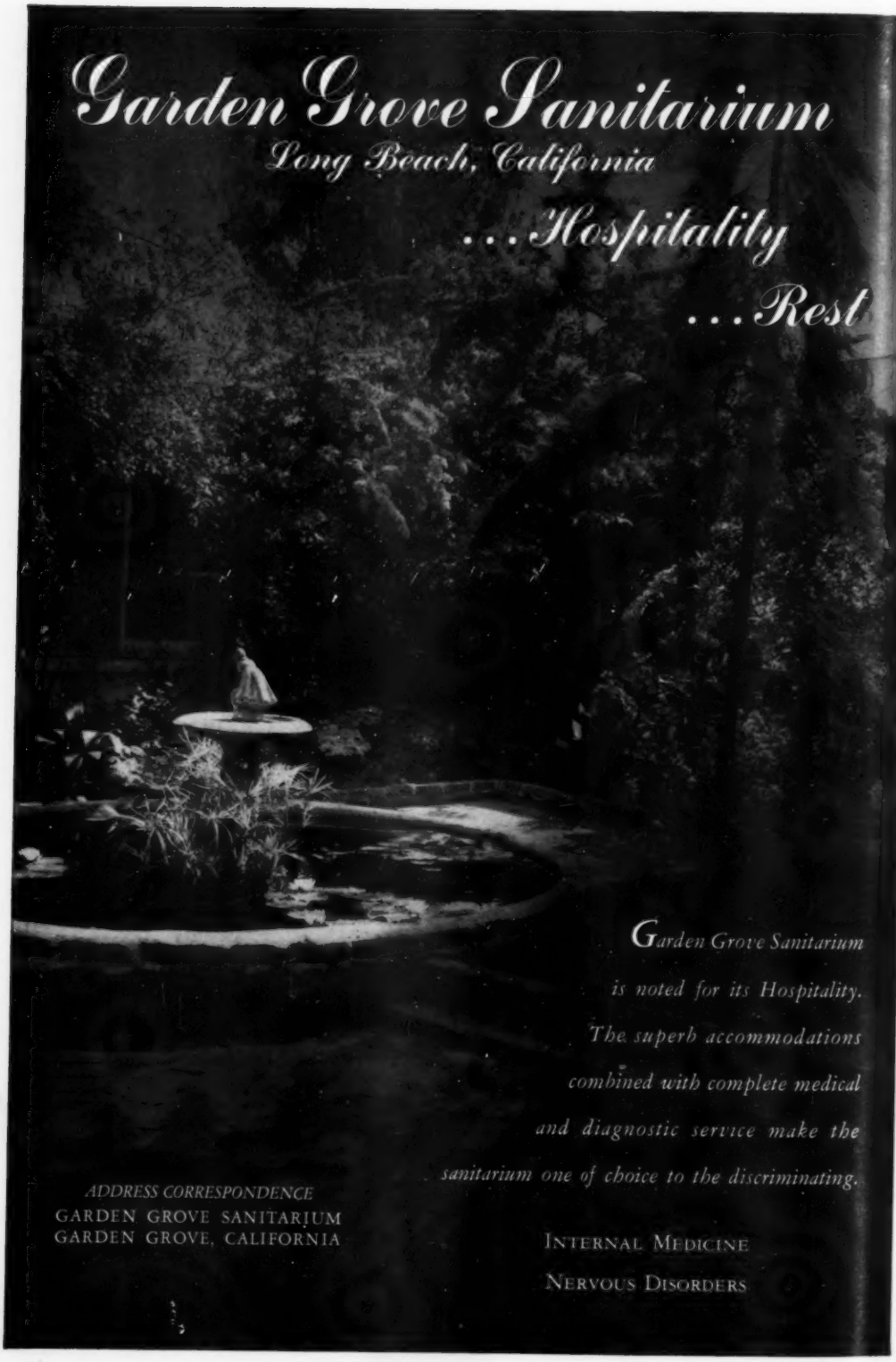

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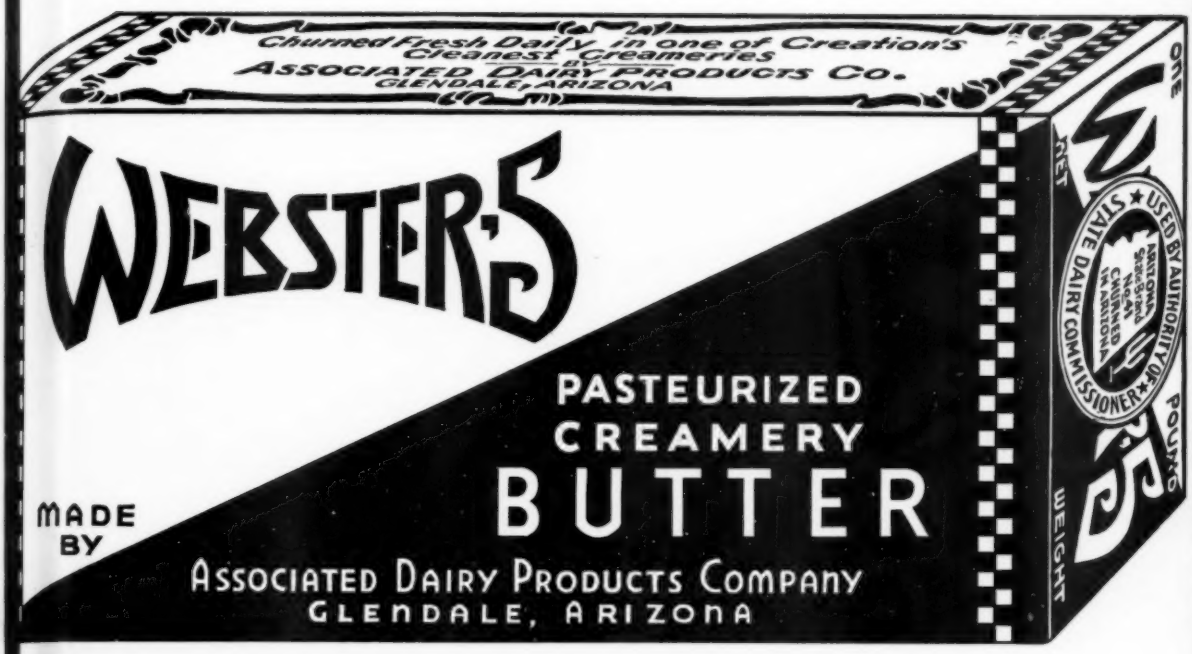


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